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SITE HEALTH AND SAFETY PLAN SOLID WASTE MANAGEMENT UNITS 17 AND 22
(SWMU 17 AND 22) MILLINGTON SUPPACT TN
1/1/2014
RESOLUTION CONSULTANTS

SITE HEALTH AND SAFETY PLAN

SWMU 17 & SWMU 22
NAVAL SUPPORT ACTIVITY MID-SOUTH
MILLINGTON, TENNESSEE

Revision: 0

Prepared for:



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SITE HEALTH AND SAFETY PLAN

This Site Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards that may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury. By signing below, I acknowledge that I have reviewed and hereby approve the HASP for Naval Support Activity Mid-South. This HASP has been written for the exclusive use of Resolution Consultants, AECOM, EnSafe, their employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

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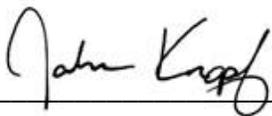


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EXECUTIVE SUMMARY

The purpose of this Site Health and Safety Plan (HASP) is to address health and safety concerns related to Resolution Consultants-managed activities at Naval Support Activity Mid-South, located in Millington, Tennessee. The specific roles, responsibilities, authority, and requirements as they pertain to the safety of employees and the scope of services are discussed herein. The document is intended to identify known potential hazards, and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

SUMMARY TABLE					
Resolution Consultants Statement of Work		Resolution Consultants will be: Performing soil borings to depths of approximately 15 feet below land surface using Direct Push Technology methods Temporary well installations to 45-55 feet Conducting long-term groundwater monitoring of Solid Waste Management Units 17 and 22 of Naval Support Activity Mid-South to evaluate the remedy effectiveness Evaluating soil and water conditions around a former underground storage tank using Direct Push Technology			
Tristate Testing		Subcontractor will be providing direct push and well installation services.			
PRIMARY PHYSICAL HAZARDS					
x	Underground Utilities	x	Traffic Control	x	Electrical Hazards
x	Overhead Utilities	x	Slips, Trips/Walking Surface	x	Hand & Power Tools
x	Drilling and Boring	x	Manual Lifting		
x	DPT Rig Operations	x	Wildlife, Plants & Insects		
CHEMICAL HAZARDS, MONITORING, ACTION LEVELS					
Contaminant of Concern		MONITORING		ACTION LEVELS	
1,2-dichloropropane, Volatile Organic Compounds, Benzene, Ethylbenzene, Toluene, and Xylene		Photo Ionization Detector with 11.7eV		0.5 parts per million (ppm) for Benzene	

All staff is bound by the provisions of this HASP and are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the HASP, such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss: the anticipated scope of work, required controls, identify new hazards and controls, incident reporting, review the results of inspections, and any lessons learned or concerns, from the previous day.

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Attachment B	Task Hazard Analyses
Attachment C	Applicable SH&E SOPs
Attachment D	Material Safety Data Sheets

List of Acronyms

AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
BOS	Base Operating Service
bgs	Below ground surface
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COC	Contaminant of Concern
CRZ	Contaminant Reduction Zone
CSI	Confirmatory Sampling Investigation
CSP	Certified Safety Professional
DPT	Direct Push Technology
EAP	Emergency Action Plan
HASP	Site Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	Investigative-Derived Waste
SDS	Safety Data Sheet
NSA	Naval Support Activity Mid-South
OSHA	Occupational Safety and Health Administration
PID	Photo Ionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	Parts per million
SH&E	Safety, Health, and Environmental
SOP	Standard Operating Procedure
SOW	Statement of Work
SSO	Site Safety Officer
SWAP	Safe Work Assessment and Permit
SWMU	Solid Waste Management Units
U.S. EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Corrective Action

1.0 INTRODUCTION

This Site Health and Safety Plan (HASP) (including Attachment B-Activity Hazard Analysis) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at the Naval Support Activity (NSA) Mid-South installation in Millington, Tennessee. This HASP also identifies chemical and physical hazards known to be associated with the Resolution Consultants managed activities addressed in this document.

HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions, which may occur during field operations. All Supplements or changes to the HASP must be approved by the Resolution Consultants Health and Safety Manager or designee, and will be documented in the HASP Revision Log (Attachment A).

1.1 General

The provisions of this HASP are mandatory for all Resolution Consultants personnel engaged in fieldwork associated with the environmental services being conducted at the subject site. A copy of this HASP, any applicable HASP Supplements, and the Resolution Consultants' Safety, Health, and Environmental (SH&E) Procedures and Programmatic Health and Safety Plan shall be accessible onsite and available for review at all times. Recordkeeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs, and federal, provincial, state, and local regulations, workers shall follow the most stringent/protective requirements. Concurrence with the provisions of this HASP is mandatory for all personnel at the site covered by this HASP and must be signed on the acknowledgement page (Section 11.0).

1.2 Project Policy Statement

Resolution Consultants is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment and communities in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless waste and loss. It shall be the policy of this project that all operations be conducted safely. Onsite supervisors are responsible for those they supervise by maintaining a safe and healthy working environment in their areas of responsibility, and by fairly and uniformly enforcing safety and health rules and requirements for all project personnel.

Subcontractors shall comply with the requirements of this HASP, provisions contained within the contract document, and all applicable rules, requirements, and health, safety, and environmental regulations. All practical measures shall be taken to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

1.3 References

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), *Occupational Safety and Health Standards* (with special attention to Section 120, *Hazardous Waste Operations and Emergency Response*).
- Title 29, CFR 1926 of the Code of Federal Regulations (29 CFR 1926), *Safety and Health Standards for Construction*.
- National Institute for Occupational Safety and Health/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard/U.S. Environmental Protection Agency (U.S. EPA), *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, 1985.
- Resolution Consultants, *Programmatic Health and Safety Plan, 2012*.



2.0 SITE INFORMATION AND SCOPE OF WORK

Resolution Consultants will conduct environmental services located at NSA Mid-South, Solid Waste Management Units (SWMUs) 17 and 22. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Sampling and Analysis Plan (SAP) developed for SWMUs 17 and 22. Deviations from the listed SOW will require that the Resolution Consultants Health and Safety Manager or designee review any changes made to this HASP to ensure adequate protection of personnel and other property. All changes to this HASP must be documented in Attachment A.

The following is a summary of relevant data concerning the project site, and the work procedures to be performed. The Project Work Plan prepared by Resolution Consultants as a companion document to this HASP provides more detail concerning both site history and planned work operations.

2.1 Site Information

This section provides a general description and historical information associated with the site.

2.1.1 General Description

The Site is located in Millington, Tennessee. The remedial action consists of:

- Conducting temporary groundwater monitoring of SWMU 17
- Using direct push technology (DPT) to characterize soil contaminant levels at SWMU 22

2.1.2 Site Background/History

SWMUs 17 and 22 are located on the Southside portion of NSA Mid-South.

SWMU 17

SWMU 17 is approximately 100 feet north of Ticonderoga Street on NSA Mid-South's Southside. Topography slopes slightly downward to the south and west. SWMU 17 consists of (1) an asphalt-covered lot that was formerly used to store landscaping equipment; (2) an area where a former building (Building S-9) was used as a maintenance shop and office space by a landscaping contractor, and a current building (Building 940) is used as a vehicle maintenance shop; and (3) former underground waste/storage tank (UST) S-9. Installed in 1979 and removed in 1996, UST S-9 is reported to have received waste automotive oil and hydraulic fluid generated during automobile maintenance at former Building S-9.

The site was initially investigated in 1990 as part of the *Resource Conservation and Recovery Act Facility Assessment*. Due to the former operations at the site, the UST at Building S-9 was designated as SWMU 17, warranting further evaluation to determine its potential risk to human health and the environment.

In addition to the 1990 *Resource Conservation and Recovery Act Facility Assessment*, previous investigations at SWMU 17 include a Voluntary Corrective Action (VCA), conducted by Koester Environmental Services, Inc. in 1996, to remove the UST and associated soil. Soil and groundwater data from the removal action indicated that a prior release from the UST had occurred. Therefore, to determine the nature and extent of contaminants related to the UST and its piping, a Confirmatory Sampling Investigation (CSI) was conducted in 1998. The results of the SWMU 17 CSI are provided in the *Assembly F RCRA Facility Investigation Report* (EnSafe 2000). From the findings of the CSI, a recommendation was made for additional soil removal; a second VCA was conducted in June 2000 to remove the residual petroleum-contaminated soil (EnSafe 2001). Analytical data from these investigations and the associated removal activities resulted in the remedy for SWMU 17 that prohibits use of the site's groundwater.

SWMU 22

SWMU 22 is the location of four former USTs at the former Boiler Plant (Building S-75). The site contained three field-constructed concrete USTs (No. 1244, 1245, and 1246), used for heating oil, and one steel UST (S75-W), used for diesel fuel. The three heating oil tanks were located on the west portion of the SWMU, while the diesel fuel tank was located near the southwest corner of the former Building S-75. Data associated with the 1992 closure of UST S75-W indicated a petroleum release had occurred and residual contamination had migrated beneath the boiler plant building. This UST, along with the three others, was assessed to determine the soil and groundwater impacts and appropriate corrective measures. Due to the petroleum related impacts associated with the former Tank S75-W and the lack of closure documentation associated with USTs 1244, 1245, and 1246, SWMU 22 was designated as a site warranting further evaluation to determine whether hazardous constituents were present.

A subsequent *Confirmatory Sampling Investigation* (EnSafe 1997) was completed and, based on the findings of the investigation, a more comprehensive *Resource Conservation and Recovery Act Facility Investigation* (EnSafe 2000) was completed. Analytical results from these investigations resulted in the *Resource Conservation and Recovery Act Facility Investigation* recommendation to remove petroleum contaminated soil. Accessible soil was removed through a VCA (EnSafe 2001),

while removal of contamination that extended beneath the building was deferred pending the building's demolition. Building S-75 has since been demolished. Clean closure was achieved for the three heating oil tanks. The U.S. Army Corps of Engineers removed the USTs in 2000 and was reportedly scheduled to complete the soil removal concurrently; however, no documentation exists as to whether the soil removal action was completed for the diesel UST, S75-W.

2.1.3 Previous Investigations

- EnSafe. *Resource Conservation and Recovery Act Facility Investigation Report, Naval Support Activity Memphis, SWMUs 17 and 22, Northside Fluvial Groundwater.* 2000a.
- EnSafe. *Aquifer Characterization Test Report, Area of Concern A, Naval Support Activity Mid-South.* Millington, Tennessee. 2000b.
- EnSafe. *Resource Conservation and Recovery Act Facility Investigation Report Addendum, Naval Support Activity Memphis, SWMUs 17 and 22, Northside Fluvial Groundwater.* 2000c.
- Progress Reports from 2006 through 2011 (Spectra Tech and EnSafe).

2.2 Scope of Work

The primary activities associated with the SOW include soil boring/drilling, temporary well installation, and groundwater sampling.

2.2.1 Mobilization/Demobilization

Mobilization and demobilization represent limited pre and post-task activities. These activities include driving to and from the site; initial site preparations, mobilization of DPT, removing equipment and Investigative Derived Waste (IDW) drums, and general housekeeping. This activity does not represent any intrusive activities.

2.2.2 Site Preparation

Site preparation includes locating proposed injection and monitoring wells. Other pre-work activities, such as the stockpiling of well installation materials, utility mark-out and clearance, and the set-up of other work support-related items are included as well. Dig permits are required throughout NSA. This should be submitted three weeks prior to the start of field activities. Upon receipt of the dig permit, NSA utilities will be marked by the Base Operating Service (BOS) contractor. In addition to the BOS contractor, Tennessee One Call will be used. If utility locations

cannot be verified onsite by the public authority, then a private utility location contractor may need to be utilized to confirm/deny the presence of private underground utilities on the site. Typically, lead-time is three (3) days and the permits are generally valid for 10 days. Consult the specific clearance dates associated with the permit obtained for the site.

2.2.3 Groundwater Sampling

This activity will include the collection of groundwater samples from the newly installed temporary monitoring wells. Groundwater samples will be collected through low-flow sampling techniques using submersible pumps. The major activities involved with this task include the following:

- Complete sampling event notifications and receive approval
- Set-up for sampling activities
- Collect groundwater samples
- Prepare and ship samples
- Perform administrative activities associated with sample collection, processing, and shipping

2.2.4 Soil Sampling

Soil samples will be collected using DPT techniques during well installation activities. During sampling activities at SWMUs 17 and 22, appropriate air monitoring will be conducted and the appropriate chemical resistant personal protective equipment (PPE) will be worn to protect against exposure. The major activities involved with collecting samples from the site include the following:

- Set-up for sampling activities
- Collect soil samples using DPT methods
- Prepare and ship samples
- Perform administrative activities associated with sample collection, processing, and shipping

2.2.5 Well Installation Oversight

Resolution Consultants personnel will be performing oversight for the installation of three temporary monitoring wells installed via DPT in the upper section of the fluvial water bearing zone to assess whether 1,2-dichloropropane contamination remains present in the groundwater beneath SWMU 17. The temporary monitoring wells will be constructed with one-inch diameter polyvinyl chloride (PVC) and are to be installed to a depth range of 45 to 55 feet below ground surface (bgs), consisting of one-inch diameter, 10 feet of PVC pipe screen and 10 feet of PVC riser pipe. Monitoring wells will not be completed with permanent manholes since they are anticipated for a single sampling event only.

The following are the steps for the well installation oversight:

- Complete pre-installation and sampling event notifications and receive approval
- Set-up for well installation
- Monitor air quality in the workers breathing zone
- Log soils and screen with a Photo Ionization Detector
- Perform administrative activities

2.2.6 Investigative-Derived Waste Management

Historically, soil and water waste that has been categorized as non-hazardous will be handled per the IDW SOP of the Sampling and Analysis Plan. If waste is deemed hazardous based on its analytical profile, waste will be staged and arranged for proper offsite disposal. Non-hazardous solid waste (e.g., PPE, bags, plastic sheeting, tubing) will be disposed of in clear plastic bags and NSA Mid-South PWD Environmental personnel will advise of disposal.

2.2.7 Equipment Decontamination

Resolution Consultants and subcontractor personnel will perform decontamination of equipment used to perform work within controlled work areas.

Pre-cleaned and dedicated sampling materials/equipment will be used, when possible, to collect the soil and groundwater samples for laboratory analysis. After the samples are collected, any disposable or one-time use equipment (e.g., tubing, bladders) will be placed in a plastic bag for disposal, as IDW, per accordance with Section 2.2.6. Non-disposable sampling and drilling equipment that contacted the soil and/or groundwater will be decontaminated between each sampling location. Gross sediments and/or contamination will first be removed from the sampling and drilling equipment. The equipment will then be washed with deionized water and Alconox detergent and then rinsed with deionized water.

2.2.8 Additional Work Operations

Operations at the site may require additional tasks not identified in this section or addressed in Attachment B, Activity Hazard Analysis (AHA). Before performing any task not covered in this HASP an AHA must be prepared, and approved by the Resolution Consultants Health and Safety Manager or designee.

3.0 HAZARD ASSESSMENT (SAFETY)

3.1 Physical Hazards

The following physical hazards are anticipated to be present onsite. Additional hazards may be noted on the AHAs developed for the individual tasks.

3.1.1 Slips, Trips, Falls, and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of 4 feet or greater above the next lower level. Protruding objects are any objects that extend into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove or label the protruding object with an appropriate warning.

3.1.2 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., clear plastic trash bags) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Additional information on the requirements of housekeeping can be found in *SOP 5-307, Housekeeping and Worksite*.

3.1.3 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials, and at a minimum, use at least two people to lift or roll/lift with your arms as close to the body as possible. For additional requirements, refer to *SOP 5-308, Manual Lifting* and *SOP 5-308, Manual Lifting Safe Work Practices*.

3.1.4 Utilities

Various forms of underground/overhead utility lines or pipes may be encountered during site activities. Prior to the start of intrusive operations, utility clearance is mandated, as well as obtaining authorization from all concerned public utility department offices. If insufficient data is

available to accurately determine the location of the utility lines, Resolution Consultants will hand clear to a depth of at least 4 feet bgs in the proposed areas of subsurface investigation. Should intrusive operations cause equipment to come into contact with utility lines, the Site Safety Officer (SSO) and Resolution Consultants Health and Safety Manager or designee will be notified immediately. Work will be suspended until the applicable utility agency is contacted and the appropriate actions for the particular situations can be taken. The phone number for the applicable state agency is provided in the Emergency Contacts list found in Section 10, Table 10-1. For additional requirements, refer to *SOP 5-417, Utilities Underground*.

Ensure drill rig operators, truck drivers, signal person, etc., are aware when working around overhead power lines. Overhead power and utility lines may be present on, or adjacent to, the site and represent a potential hazard during the mobilization/demobilization of equipment and supplies. Maintain a minimum of 10 feet between overhead power lines and the drill mast and/or cab of trucks, etc. Any deviation must be approved by the Resolution Consultants Health and Safety Manager or designee. Additional information on working adjacent to overhead power and utility lines can be found in *SOP 5-406, Electrical Lines, Overhead*.

3.1.5 Electrical Hazards

Electrical and powered equipment may be used during a variety of site activities. Injuries associated with electrical and powered equipment include electric shock, cuts/lacerations, eye damage (from flying debris), and burns. To reduce the potential of injury from the hazards associated with electrical and powered equipment, always comply with the following:

- Use ground fault circuit interrupters when using electrical powered tools/equipment. Ground fault circuit interrupters prevent electrical shock by detecting the loss of electricity from a power cord and/or electrical device.
- Ensure generators are properly grounded.
- Wear American National Standards Institute (ANSI)-approved (Z87.1) safety glasses. Face shields may be required to provide additional face protection from flying debris.
- Wear appropriate work gloves. Work gloves may reduce the severity of burns and cuts/lacerations.

All temporary electric installations (site trailer, subpanels) will comply with OSHA (29 CFR 1926, Subpart K, and 29 CFR 1910, Subpart S) guidelines. Only qualified and competent individuals (licensed electrician) will provide electrical service/servicing. Refer to *SOP 5-410, Hazardous Energy Control*, for additional requirements and information.

3.1.6 Heavy Equipment and Vehicle Operations

Heavy equipment and site vehicles present serious hazards to site personnel. Blind spots, failure to yield, and other situations may cause heavy equipment/vehicles to come into contact with personnel. To reduce the possibility of contact between equipment/traffic and personnel, always adhere to the following:

- Personnel must wear a high visibility, reflective safety vest at all times when working near heavy equipment and/or other vehicle traffic.
- Personnel must always yield to equipment/vehicle traffic and stay as far as possible from all equipment/vehicle traffic. Always maintain eye contact with operators.
- When feasible, place barriers between work areas and equipment/vehicle traffic.
- Always ensure reverse warning alarms are working and louder than surrounding noise. Personnel must report inoperative reverse warning alarms.
- Ensure Daily Equipment Safety Inspections are being performed and documentation filed at the site.

For additional requirements, refer to *SOP 5-309, Mobile or Heavy Equipment*.

3.1.7 Drilling Operations

Drilling operations including DPT (Geoprobe or similar), present their own set of hazards. Several basic precautions that should be taken include, but are not limited to, confirming locations of underground and overhead utilities, wearing of appropriate PPE and the avoidance of loose clothing or jewelry, staying clear of moving parts, knowing the locations of emergency shut-off switches. Other operational safety precautions regarding moving the drilling equipment, raising and lowering the derrick (mast), and drilling can be found in *SOP 5-405, Drilling and Boring*.

3.1.8 Excavations and Trenches

No excavations or trenching are anticipated during this phase of work.

3.1.9 Spill Prevention

Work activities may involve the use of hazardous materials (e.g., fuels, solvents) or work involving drums or other containers. The following procedures will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers.
- Tops/lids will be placed back on containers and secured after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (e.g., speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (e.g., fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- For drums/containers, follow the procedures in 5-308, *Manual Lifting Safe Work Practices*, to minimize spillage.

3.1.10 Noise Exposure Monitoring

When heavy equipment is in operation, it will be necessary to ensure that each exclusion zone fully encompasses all areas where hazardous noise levels are present (85 decibels on the A-weighted scale or greater). During this project, all personnel will be required to use hearing protection when in the vicinity of heavy equipment use or for operations where individuals must raise their voice to be heard at arm's length. Refer to *SOP 5-510, Hearing Conservation Program*, for additional information and requirements.

3.1.11 Traffic Control

General traffic control precautions include placing a work vehicle between your worksite and oncoming traffic whenever possible. Not only is it a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle rather than your body would absorb the first impact of a crash. Turn the vehicle wheels so that if it was struck, it would swing away from the worksite. When using cones or other devices to modify traffic flow, ensure use of the

proper taper length and devise spacing to provide adequate warning distance to oncoming motor vehicles. In addition, proper PPE is to be worn during traffic operations, to include hardhat and high-visibility vests. Refer to *SOP 5-306, Highway and Road Work*, for additional requirements.

3.2 Biological Hazards

It is possible that biological hazards may be present on the project site. Poisonous plants along with ticks and other biting insects may be present along the tree lines. Stinging insects, such as bees and wasps, may be within proximity of the work zone. Below is a discussion of the most common biological hazards found on project sites, and those anticipated to be of concern here.

3.2.1 Small Mammals

Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against. The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).

3.2.2 Venomous Animals

Some animals have the ability to inject venom. These include rattlesnakes, black widow spiders, and scorpions. These all have limited distributions, so in most areas you are unlikely to encounter them. Other spiders possess venom but they are generally not harmful to humans. Shrews have poisonous saliva, but the chance of being envenomed by them is extremely unlikely unless they are handled.

If bitten by any animals special care should be taken to treat the wound as it may lead to complications due to the toxin. A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

3.2.3 Poisonous Plants

Sensitivity to toxins generated by plants, insects, and animals varies according to dosage and the ability of the victim to process the toxin; therefore, it is difficult to predict whether a reaction will occur or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the exposure can result in severe scarring, blindness, or even death.

Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed (or Giant Cow Parsnip), Wild Parsnip, Devil's Club, and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock, Water Parsnip) — do not eat anything that has not been identified.

A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. Do not eat any berries or plants that you are not absolutely sure of their identity. Examples of common poisonous or irritating plant species, common to the United States, are shown in Table 3-1.

Table 3-1 Hazardous Plant Identification Guide	
<p>Poison Ivy</p> <ul style="list-style-type: none"> • Grows in West, Midwest, Texas, East • Several forms (vine, trailing shrub, or shrub) • Three leaflets (can vary 3-9) • Leaves green in summer, red in fall • Yellow or green flowers • White berries 	
<p>Poison Oak</p> <ul style="list-style-type: none"> • Grows in the East (NJ to Texas), Pacific Coast • 6-foot tall shrubs or long vines • Oak-like leaves, clusters of three • Yellow berries 	

3.2.4 Insects

Insects for which precautionary measures should be taken include mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, and fire ants.

Wasps and bees are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.

Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. Most serious concern is possibility of contracting Lyme disease, which is spread by the Black-legged or Deer Tick. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.

3.3 Ultraviolet Hazards

The 2010 Historical Ultraviolet (UV) Index for the Millington, Tennessee, area showed that worker's UV exposures were in the HIGH category beginning in May, and lasting until September, with worker's exposures in the EXTREME category from July through August. Workers performing fieldwork outdoors may be susceptible to sunburn if not properly protected with sunscreen or protective clothing and hats. Skin can burn in minutes when the UV Index is VERY HIGH. Protective measures are advisable.

3.4 Weather Hazards

The SSO will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact are to be included in safety briefings and the Safe Work Assessment and Permit (SWAP) for that day. Weather changes should initiate a review and updates (SWAPs) as necessary. Weather-related hazards will directly correlate to the type of weather involved. Hot, dry weather may cause greater dust emissions, particularly during intrusive activities. Rain may increase slip/trip hazards, particularly for ground workers.

Severe weather can occur with little warning. Employees will be vigilant for the potential for storms, lightning, high winds, and flash flood events. Additionally, lightning strikes during electrical storms could also be a potential hazard. The following four procedures will be implemented once thunder is heard or lightning spotted:

- 1) If thunder is heard, all site personnel are to be alert of any visible lightning flashes. The SSO will observe the storm front and track the direction it is moving. The SSO will continue to observe the storm front until it passes or until the prevailing direction is determined to be away from the site.
- 2) If lightning is observed, the Site Supervisor or SSO are to be notified. When the next lightning flash is observed, a "second" count shall be initiated from the time the lightning is observed until the thunder from the strike is heard.

- 3) The following action guidelines shall be implemented once the “second” count is ≤ 30 seconds:
 - a) “second” count > 30 , the Site Supervisor or SSO will continually observe the storm front. If the front is moving away, work will continue. If the front is moving towards the site, the Site Supervisor will initially place workers on alert for potential evacuation.
 - b) “second” count ≤ 30 , the Site Supervisor will issue the evacuation command and all workers are to report to the designated rally point as decided by the SSO or designated employee. Work can be re-initiated once the front has passed by and thunder has not been heard for 30 minutes.
- 4) If lightning is observed and the storm front is moving away from or around the site and is > 20 miles away, work will be permitted to continue. The location of the storm can be confirmed via internet access to a local weather website that has a Doppler radar tracking system.

3.5 Activity Hazard Analysis

AHAs have been completed for all tasks identified in the SOW:

- Mobilization/Demobilization
- Direct push oversight
- Groundwater Sampling
- Unanticipated Work Activities/Conditions

As a result of unanticipated work activities or changing conditions, additional AHAs may be required. All additional AHAs will be reviewed and approved by the Resolution Consultants Health and Safety Manager or designee.

3.6 Task Specific SH&E Procedures

As discussed in Section 5.0, personnel may be exposed to a variety of chemical, physical, and radiological hazards resulting from task or equipment-specific activities. In addition to the site-specific SOPs related to environmental sampling, the controls for work hazards are discussed in the Resolution Consultants SH&E SOPs. Copies of applicable health and safety SOPs as referenced in Table 3-2 are located in Attachment C.



Table 3-2 Applicable SOPs					
	SOP#	Title		SOP#	Title
<input checked="" type="checkbox"/>	5-305	Hand and Power Tools	<input checked="" type="checkbox"/>	5-510	Hearing Conservation Program
<input checked="" type="checkbox"/>	5-306	Highway and Road Work	<input checked="" type="checkbox"/>	5-511	Heat Stress Prevention
<input checked="" type="checkbox"/>	5-307	Housekeeping, Worksite	<input checked="" type="checkbox"/>	5-208	Personal Protective Equipment
<input checked="" type="checkbox"/>	5-308	Manual Lifting, Field			
<input checked="" type="checkbox"/>	5-309	Mobile or Heavy Equipment			
<input checked="" type="checkbox"/>	5-313	Wildlife, Plants and Insects			
<input checked="" type="checkbox"/>	5-405	Drilling and Boring			
<input checked="" type="checkbox"/>	5-406	Electrical Lines, Overhead			
<input checked="" type="checkbox"/>	5-417	Utilities, Underground			
<input checked="" type="checkbox"/>	5-507	Hazardous Materials Communication/WHMIS			

4.0 SH&E REQUIREMENTS (SAFETY)

4.1 HAZWOPER Qualifications

Personnel performing work at the job site must be qualified as Hazardous Waste Operations and Emergency Response (HAZWOPER) workers (unless otherwise noted in specific AHAs or by the SSO), and must meet the medical monitoring and training requirements specified in the Resolution Consultants' SH&E SOPs. If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit, employees may be required to receive supplemental medical testing to document any symptoms that may be specific to the particular materials present.

4.2 Site-Specific Safety Training

All Resolution Consultants personnel performing activities at the site will be trained in accordance with *5-003 SH&E Training*. All personnel are required to remain current in all of their required training and evaluate their need for additional training when there is a change in work. In addition to the general health and safety training programs, personnel will be required to complete any supplemental task specific training developed for the tasks to be performed. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the project or lead manager. Any additional required training that is completed will be documented and tracked in the project files.

4.2.1 Competent Person Training Requirements

To complete the planned SOW, a competent person (per OSHA definition) must be designated to perform the required daily onsite inspections of operations and/or equipment. The competent person may be a Resolution Consultants' (if responsible for supervising that activity) or the subcontractor's employee. Designated competent person(s) for this project are shown in Table 4-1.

Table 4-1 Task-Specific Competent Persons		
Employee Name	Organization	Area of Competency
Kate Freeman	Resolution Consultants	Field Sampling Team Leader
TBD	Tri-State Drillers	Drilling

Note:

The training requirements for competent persons are specified in the indicated SOPs and/or *5-202 Competent Person Designation*. By identifying an employee as a "competent person", that person has now been authorized to take prompt corrective measures to eliminate hazards.

4.3 Tailgate Meetings

Prior to the commencement of daily project activities, a tailgate meeting will be conducted by the SSO to review the specific requirements of this HASP, applicable AHAs, and the daily SWAP. Attendance at the daily tailgate meeting is mandatory for all employees at the site covered by this HASP, and must be documented on the attendance form. All safety training documentation is to be maintained in the project file by the SSO.

4.4 Hazard Communication

Hazardous materials that may be encountered as existing onsite environmental or physical/health contaminants during the work activities are addressed in this HASP, and their properties, hazards and associated required controls will be communicated to all affected staff and subcontractors. In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this Resolution Consultants-controlled work site must first provide a copy of the item's Safety Data Sheet (SDS) to the SSO for review and filing (the SSO will maintain copies of all SDS onsite). SDSs may not be available for locally obtained products, in which case some alternate form of product hazard documentation will be acceptable in accordance with the requirements of *SOP 5-507 Hazardous Materials Communication/WHMIS*.

All personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of, and have access to all MSDSs.

All containers onsite shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use, shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.). Attachment D contains copies of MSDSs for those items planned to be brought onsite at the time this HASP is prepared. This information will be updated as required during site operations.

4.5 Confined Space Entry

There will be no confined spaces involved in these activities.

4.6 Hazardous, Solid, or Municipal Waste

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable federal, state, provincial, territorial, and/or local regulations. Consult the Project Manager for further guidance.

4.7 General Safety Rules

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to *SOP 5-001 Safe Work Standards and Rules* and *SOP 5-307 Housekeeping, Worksite*.

4.7.1 Smoking, Eating, or Drinking

Smoking, eating, and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any Resolution Consultants' site. Smoking, eating, or drinking must be in an approved area.

4.7.2 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

Potable Water — An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources. In addition, all potable water coolers that offer direct drinking access will be sealed to protect the integrity of the drinking water.

Non-Potable Water — Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes and will be labeled as follows:

***Non-Potable Water
Not Intended for Drinking Water Consumption***

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel onsite, with separate toilets maintained for each sex except where there are less than five total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities, onsite facilities are not required.



Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone, prior to breaks, and at the end of daily work activities.

4.7.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization onsite can serve as "buddies" for Resolution Consultants personnel. Under no circumstances will any employee be present alone in a controlled work area.

4.8 Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions as outlined in *SOP 5-002, Stop Work Authority*. Whenever the SSO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSO is authorized and required to stop work, which shall be immediately binding on all affected Resolution Consultants employees and subcontractors.

Upon issuing the stop work order, the SSO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Resolution Consultants Health and Safety Manager or designee has concurred that workplace conditions meet acceptable safety standards.

4.9 Client Specific Safety Requirements

The client has specified no additional health and safety requirements.

5.0 EXPOSURE MONITORING PROCEDURES (HEALTH)

5.1 Contaminant Exposure Hazards

The following is a discussion of the hazards presented to worker personnel during this project from onsite chemical and radiological hazards known, suspected, or anticipated to be present. Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the SOW are located in the following subsections.

1. Tetrachloroethylene
2. Trichloroethene
3. 1,2-Dichloroethene
4. Vinyl chloride
5. Benzene

5.2 Real-Time Exposure Measurement

Monitoring shall be performed within the work area onsite to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Table 5-1 specifies the real-time monitoring equipment, which may be used for this project. At a minimum, a PID will be used with additional instrumentation introduced in the field as warranted by site-specific conditions.

Table 5-1 Monitoring Parameters and Equipment		
Instrument	Manufacturer/Model*	Substances Detected
Photo Ionization Detector	RAE Systems mini-RAE Photovac Microtip HNU Model HNU (min. 11.7 eV bulb)	Petroleum hydrocarbons Organic Solvents
Colorimetric Detector Tubes	Draeger or Sensidyne equiv.	Benzene 0.5-10 ppm (e.g., Draeger 6728561, Benzene 0.5/a)

Note:

*Or similar unit, as approved by the Resolution Consultants Health and Safety Manager or designee

5.2.1 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants in the work area or other environmental conditions. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone.

If ambient levels are measured, which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and mitigative actions to limit access, etc.) must be implemented prior to recommencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of SSO or the Resolution Consultants Health and Safety Manager or designee.

Reasons to upgrade:

- Known or suspected presence of dermal hazards
- Occurrence or likely occurrence of gas, vapor, or dust emission
- Change in work task that will increase the exposure or potential exposure to hazardous materials

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally suspected
- Change in site conditions that decrease the potential hazard
- Change in work task that will reduce exposure to hazardous materials

5.2.2 Monitoring Procedures

Atmospheric monitoring will be conducted during drilling activities with a PID, if warranted, based on any notable odors. If hydrocarbon odors are noted during the field activities, the SSO will assess the atmosphere for acceptable concentrations/levels to determine whether additional instrumentation should be added to the PID, and PPE should be upgraded based on the action levels provided in Table 5-2.

Table 5-2 Monitoring Procedures and Action Levels			
Parameter	Location and Interval	Response Level (Meter units/ppm above background)	Response
Hydrocarbons (Total by PID, see "RESPONSE" for chemical-specific monitoring using detector tubes when meter units are ≥ 1 ppm)	Continuous in the worker's breathing zone or in the immediate work area for sustained reading of two (2) minutes in duration.	< 1 ppm	Continue Level D or Modified Level D work and continue monitoring.
		PID ≥ 1 ppm and; benzene < 1 ppm vinyl chloride < 1 ppm	Periodically monitor with chemical-specific detector tubes. Contact the SSO or Resolution Consultants Health and Safety Manager or designee, implement mitigation measures, and continue work in Level D. See chemical-specific monitoring information below and continue monitoring.
		PID ≥ 5 ppm	Upgrade to Level C PPE (minimum P100 and OV cartridges). Cartridge change out daily. Continue environmental monitoring.
		≥ 10 ppm or Benzene ≥ 1 ppm vinyl chloride ≥ 1 ppm	Cease work, exit the area, contact the SSO or Resolution Consultants Health and Safety Manager or designee and upgrade to Level B.
Benzene Detector tubes (e.g., Draeger 6728561, Benzene 0.5/a or equivalent)	Breathing zone, every 30 minutes where indicated by PID readings (see PID response levels above).	≥ 1 ppm	Upgrade to Level C PPE (minimum P100 and OV cartridges). Cartridge change out daily. Continue benzene monitoring.
		≥ 50 ppm	Cease work, exit the area, contact the SSO/ Resolution Consultants Health and Safety Manager or designee to discuss the potential for upgrade to Level B.

Note:

The action levels established in this section are based on the PID being used as the primary tool for real time monitoring. Colorimetric evaluation is to supplement PID monitoring permitting the SSO to identify the Contaminant of Concern causing the PID reading. Action levels require corrective measure to be implemented in such a time frame that the Time Weighted Average exposure limit is not exceeded. It is noted that there is a margin of error associated with the use of colorimetric evaluations. For this reason, colorimetric evaluation is used only to supplement PID monitoring. The PID and colorimetric evaluation used in tandem assist in compensating for limitations.

5.2.2.1 Monitoring Equipment Calibration

All instruments used will be calibrated at the beginning of each work shift, and/or in accordance with the manufacturer's recommendations. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency, or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated to specifications, site operations requiring monitoring for worker exposure or offsite migration of contaminants will be postponed or temporarily ceased until this requirement is completed.

5.2.2.2 Personal Sampling

Should site activities warrant performing personal sampling (breathing zone) to better assess chemical exposures experienced by Resolution Consultants' employees, the SSO, under the direction of a Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP) will be responsible for specifying the monitoring required.

Within five working days after the receipt of monitoring results, the CIH or CSP will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the SSO project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations and provide the results to the SSO for use in determining the potential for other employees' exposure.

5.3 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress, and watch fellow employees for signs of heat/cold stress.

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in SH&E 616, *Heat Stress Prevention Program*.

5.3.1 Responding to Heat-Related Illness

The guidance in Table 5-3 will be used in identifying and treating heat-related illness.

Table 5-3 Identification and Treatment of Heat-Related Illness		
Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	<ul style="list-style-type: none"> • Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	<ul style="list-style-type: none"> • Immediately remove the victim from the work area to a shady or cool area with good air circulation (<i>avoid drafts or sudden chilling</i>). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (<i>Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing</i>). • If the victim is conscious, it may be helpful to give him/her sips of water. • Transport victim to a medical facility ASAP.
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, and nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	<ul style="list-style-type: none"> • Immediately evacuate the victim to a cool/shady area. • Remove all protective outerwear and as much personal clothing as decency permits. • Lay the victim on his/her back w/the feet slightly elevated. • Apply cold wet towels or ice bags to the head, armpits, and thighs. • Sponge off the bare skin with cool water. • The main objective is to cool without chilling the victim. • Give no stimulants or hot drinks. • Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility.



6.0 ENVIRONMENTAL PROGRAM (ENVIRONMENT)

6.1 Environmental Compliance and Management

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements.

6.1.1 Air Emissions

No significant air emissions are anticipated.

6.1.2 Hazardous Waste Management

Hazardous Waste Management is not anticipated in the SOW.

6.1.3 Storm Water Pollution Prevention

There will be no issues with storm water. Soil cuttings will be managed as described in the applicable SOP in the project SAP.

6.1.4 Wetlands Protection

There are no wetlands in or adjacent to the proposed work zone.

6.1.5 Critical Habitat Protection

There are no critical habitats in or adjacent to the proposed work zone.

6.1.6 Environmental Protection

No major environmental impacts will be generated on this site. The drilling activities are minimally invasive in nature.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Personal Protective Equipment

The purpose of PPE is to provide a barrier that will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. *SOP 5-208 Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual AHAs. By signing this HASP, the employee agrees to having been trained in the use, limitations, care and maintenance of the protective equipment to be used by the employee at this project. If training has not been provided, request same of the Project Manager (PM)/SSO for the proper training before signing.

Table 7-1 Personal Protective Equipment		
Type	Material	Additional Information
Minimum PPE		
Safety Vest	ANSI Type II high-visibility	Must have reflective tape/be visible from all sides
Boots	Leather	ANSI Approved safety toe
Safety Glasses	ANSI Z87.1	ANSI Approved; ≥98% UV protection
Hard Hat	ANSI Z89.1	ANSI Approved; recommended wide-brim
Work Uniform		No shorts/cutoff jeans or sleeveless shirts
Additional PPE		
Hearing Protection	Ear plugs and/or muffs	In hazardous noise areas
Leather Gloves		If working with sharp objects or powered equipment.
Protective Chemical Gloves	Disposable Nitrile	Use during handling of all potentially impacted media
Sunscreen	SPF 30 or higher	

Notes:

PPE = Personal Protective Equipment
 UV = Ultraviolet
 ANSI = American National Standards Institute
 SPF = Sun Protection Factor

7.2 PPE Utilization Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE a more safe and manageable task:

- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab, while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.

- Have a “buddy” check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.

7.3 Decontamination

7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials).

All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the Exclusion Zone. For this Site, the Exclusion Zone and the Contamination Reduction Zone will be merged forming a Work Zone (see Section 9.2).

All persons and equipment entering the Work Zone shall be considered contaminated, and thus, must be properly decontaminated prior to entering the Work Zone.

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable MSDS must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

7.3.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants
- Hoses, buckets of water or garden sprayers for rinsing
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment
- Metal or plastic cans or drums for the temporary storage of contaminated liquids
- Paper or cloth towels for drying protective clothing and equipment

7.3.3 Personal/Equipment Decontamination

All equipment leaving the Work Zone shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and offsite migration of impacted materials. Such equipment may include, but is not limited to, sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders), and any handheld tools. All water used for decontamination will be managed per the applicable SOP in the project SAP.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the Work Zone. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

The PPE to be used onsite is considered disposable and will be removed and containerized in the Contamination Reduction Zone during decontamination activities. Suits and booties will be removed first, and gloves last. Personnel decontamination should consist of the following glove removal procedure:

- Grasp the cuff of the dominant hand and pull glove over the bulk of the hand, leaving the fingers inside the glove.
- Use the dominant hand to grasp the cuff of the non-dominant hand and pull the glove completely off (inside-out) and place inside of the dominant hand glove.

- Once removed, employee should only touch the inside material of the dominant hand glove.
- Thoroughly wash hands.

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination. Before heavy equipment and trucks are taken offsite, the Site Supervisor and/or SSO will visually inspect them for signs of contamination. If contamination is present, the equipment must be decontaminated.

For equipment, use the following five steps for decontamination:

1. Remove majority of visible gross contamination in Work Zone
2. Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment
3. Rinse equipment
4. Visually inspect for remaining contamination
5. Follow appropriate personal decontamination steps outlined above

All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone. Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

8.0 PROJECT HEALTH AND SAFETY ORGANIZATION

8.1 Project Manager [Corey Coleman]

The PM has overall management authority and responsibility for all site operations, including safety. The PM will provide the Site Supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

8.2 Site Supervisor [Kate Freeman]

The Site Supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while onsite.

8.2.1 Responsibilities

The Site Supervisor is responsible to:

- Discuss deviations from the work plan with the SSO and PM.
- Discuss safety issues with the PM, SSO, and field personnel.
- Assist the SSO with the development and implementation of corrective actions for site safety deficiencies.
- Assist the SSO with the implementation of this HASP and ensuring compliance.
- Assist the SSO with inspections of the site for compliance with this HASP and applicable SOPs.

8.2.2 Authority

The site supervisor has authority to:

- Verify that all operations are in compliance with the requirements of this HASP and halt any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the SSO, the Resolution Consultants Health and Safety Manager or designee, and the PM.

8.2.3 Qualifications

In addition to being HAZWOPER-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

8.3 Site Safety Officer [Eric Allen]

8.3.1 Responsibilities

The SSO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the SOW. HASP updates must be reviewed and approved by the Resolution Consultants Health and Safety Manager or designee. Updates must be documented using the HASP Revision Log in Attachment A.
- Be aware of changes in Resolution Consultants Safety Policies, Programmatic Health and Safety Plan, or SOPs.
- Monitor the lost time incidence rate for this project and work toward improving it.
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by the Resolution Consultants Health and Safety Manager or designee.
- Work with the Site Supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).
- Contact the Resolution Consultants Health and Safety Manager or designee for technical advice regarding safety issues.
- Provide a means for employees to communicate safety issues to management in a discreet manner (e.g., suggestion box, etc.)
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.

- Check that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Discuss potential health and safety hazards with the Site Supervisor, the Resolution Consultants Health and Safety Manager or designee, and the PM.
- Contact PM if unable to continue duties for any reason. The alternate SSO must be approved by the PM.

8.3.2 Authority

The SSO has authority to:

- Verify that all operations are in compliance with the requirements of this HASP.
- Issue a “Stop Work Order” under the conditions set forth in this HASP.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the Resolution Consultants Health and Safety Manager or designee and the PM.

8.3.3 Qualifications

In addition to being HAZWOPER-qualified, the SSO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

8.4 Employees

8.4.1 Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete

- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies
- Notifying the SSO, in writing, of unsafe conditions and acts

8.4.2 Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed
- The right to contact the SSO or the Resolution Consultants Health and Safety Manager or designee at any time to discuss potential concerns
- The right and duty to stop work when conditions are unsafe and to assist in correcting these conditions

8.5 Resolution Consultants Health and Safety Manager [John Knopf, CSP]

The Health and Safety Manager is assigned to provide guidance and technical support for the project. Duties include the following:

- Approving this HASP and any required changes
- Approving the designated SSO
- Reviewing all personal exposure monitoring results
- Investigating any reported unsafe acts or conditions

The Health and Safety Manager may designate another safety professional as the direct liaison for this project; if that is the case, he will remain available for any or all of the tasks listed here or elsewhere in this HASP in lieu of the designee.

8.6 Subcontractors

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in *SOP 5-213 Subcontractors*. Each Resolution Consultants subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required PPE and all required training.

Resolution Consultants considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to Resolution Consultants for review prior to the start of onsite activities, if required.

Hazards not listed in this HASP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the Resolution Consultants PM or the Site Supervisor prior to beginning work operations. The Site Supervisor or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

8.7 Visitors

Authorized visitors (e.g., client representatives, regulators, Resolution Consultants management staff, etc.) requiring entry to any work location on the site will be briefed by the PM or Site Supervisor on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training, and personal protective equipment, which are required for entry to any controlled work area; visitors must comply with these requirements at all times.



8.7.1 Visitor Access

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HASP, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following three procedures:

1. A written confirmation must be received by Resolution Consultants documenting that each of the visitors has received the proper training and medical monitoring required by this HASP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
2. Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
3. All visitors must be escorted by a Resolution Consultants employee.

If the site visitor requires entry to any Work Zone, but does not comply with the above requirements, all work activities within the Work Zone must be suspended. Until these requirements have been met, entry will not be permitted.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

9.0 SITE CONTROL

9.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on site maps, posted in the support vehicle or trailer, and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities (e.g., excavating, trenching, drilling) and are discussed in this section.

9.2 Controlled Work Areas

For this site, the Exclusion Zone and the Contamination Reduction Zone will be merged forming a Work Zone. The Work Zone is the area directly surrounding the drilling rig and sampling areas. The Support Zone will remain in the same function as it is described.

Each HAZWOPER controlled work area will consist of the following three zones:

- *Exclusion Zone:* Contaminated work area
- *Contamination Reduction Zone:* Decontamination area
- *Support Zone:* Uncontaminated or “clean area” where personnel should not be exposed to hazardous conditions

Each zone will be periodically monitored, if warranted, in accordance with the air monitoring requirements established in this HASP. The Work Zone is considered a distinct work area. The Support Zone is accessible to the public (e.g., vendors, inspectors).

9.2.1 Work Zone

The Work Zone is the combined areas of the Exclusion Zone and Contamination Reduction Zones, and is the area where primary activities occur, such as sampling, remediation operations, installation of wells, decontamination, and cleanup work. This area must be clearly marked with

hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable AHA and this HASP, will be allowed in a Work Zone. The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

- **Direct Push Drilling Activities.** A distance of 20 feet in all directions will be cleared from the rig. The cleared area will be sufficient to accommodate movement of necessary equipment and soil sampling supplies. Vehicles and other hard barriers should be used where applicable to protect employees and public.

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the Work Zone). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving.

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

9.2.2 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

9.3 Site Access Documentation

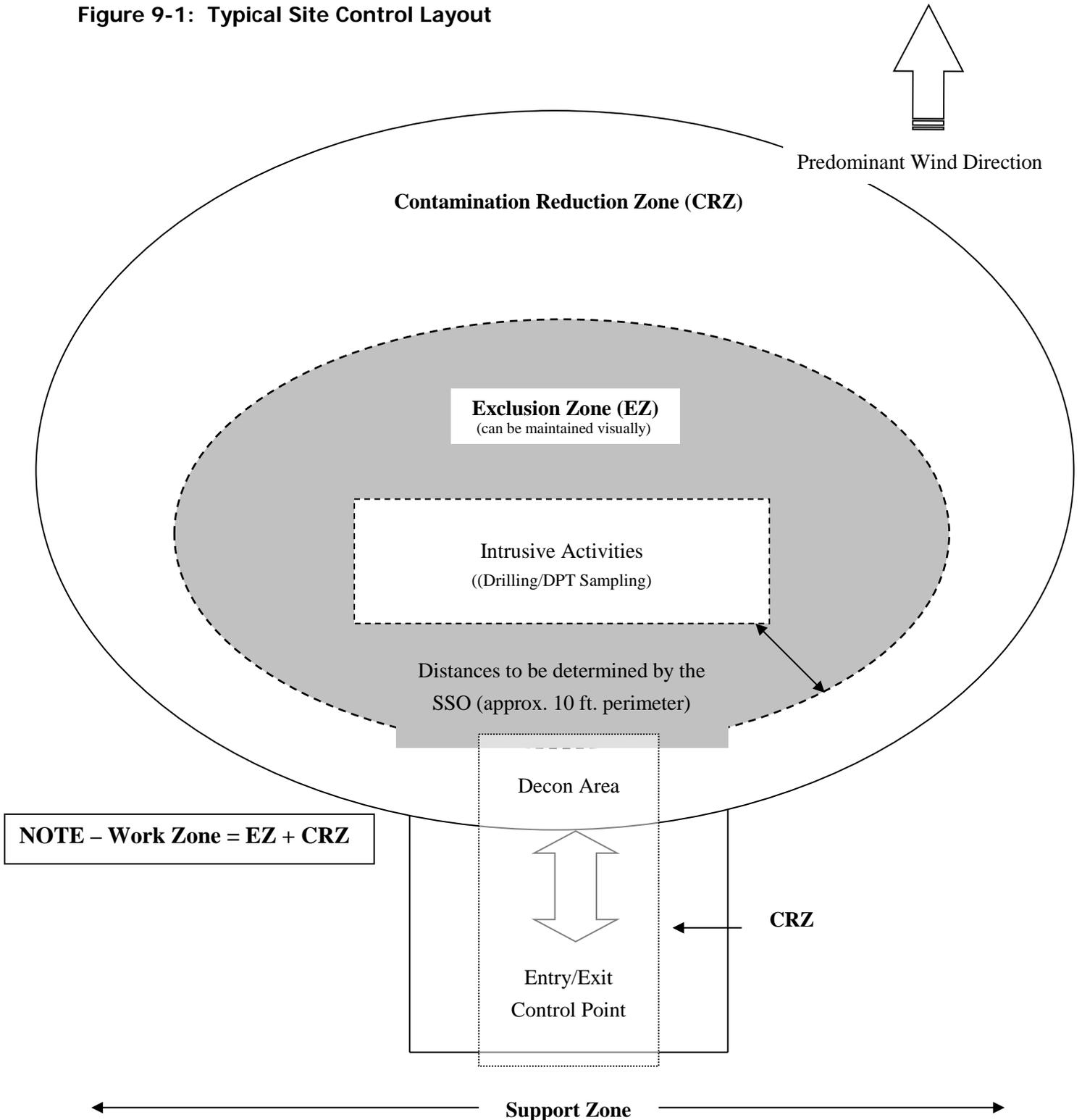
If implemented by the PM, all personnel entering the site shall complete the "Site Entry/Exit Log" located at the site trailer or primary site support vehicle.



9.4 Site Security

Site Security is not required at this site. Due to the limited nature of work scope, a site security plan will not be applicable. Should the SOW change in a way that would require security, a plan will be developed and added to the HASP.

Figure 9-1: Typical Site Control Layout



10.0 EMERGENCY RESPONSE PLANNING

10.1 Emergency Action Plan

Although the potential for an emergency to occur is remote, an Emergency Action Plan (EAP) has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the Resolution Consultants team. The EAP will be reviewed by all personnel prior to the start of field activities. A test of the EAP will be performed within the first three (3) days of the project field operations. This test will be evaluated and documented in the project records.

Four major categories of emergencies could occur during site operations:

1. Illnesses and physical injuries (including injury-causing chemical exposure)
2. Catastrophic events (fire, explosion, earthquake, or chemical)
3. Workplace Violence, Bomb Threat
4. Safety equipment problems

10.1.1 Emergency Coordinator

The duties of the Emergency Coordinator include:

- Implement the EAP based on the identified emergency condition.
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 10-1).
- Verify emergency evacuation routes and muster points are accessible.
- Conduct routine EAP drills and evaluate compliance with the EAP.



Table 10-1 Emergency Contacts			
Emergency Coordinators/Key Personnel			
Name	Title/Workstation	Telephone Number	Mobile Phone
Jim Heide	NSA Mid-South Installation Environmental Program Manager	901-874-5367	901-652-0774
Corey Coleman	Project Manager	901-937-4434	901-482-3742
Kate Freeman	Site Supervisor	901-937-4434	
Eric Allen	Site Safety Officer	901-937-4281	901-359-6698
John Knopf	Resolution Consultants H&S Manager	901-372-7962	901-451-1464
Kevin Arick	EnSafe TDG/IATA Shipping Expert	901-372-7962	901-356-3525
Organization/Agency			
Name			Telephone Number
NSA MidSouth Police/Security			901-874-7911
Millington Police Department			911
Shelby County Fire Department			911
Ambulance Service <i>(EMT will determine appropriate hospital for treatment)</i>			911
Emergency Hospital <i>(Use by site personnel is only for emergency cases)</i>			
Methodist North Hospital 3960 New Covington Pike Memphis, TN 38128			901-516-5200
Emergency Hospital Route: See Figure 10-1			
Poison Control Center			800-222-1222
Pollution Emergency			800-292-4706
National Response Center			800-424-8802
Title 3 Hotline			800-424-9346
Public Utilities			
Name			Telephone Number
<i>Call Before You Dig</i>			811 800-892-0123

Notes:

- H&S = Health & Safety
- TDG/IATA = Transportation of Dangerous Goods/International Air Transport Association

10.1.2 Site-Specific Emergency Procedures

Prior to the start of site operations, the Emergency Coordinator will complete Table 10-2 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

Table 10-2 Emergency Planning		
Emergency	Evacuation Route	Muster Location
Chemical Spill	<ul style="list-style-type: none"> • Upwind 	<ul style="list-style-type: none"> • Site vehicles
Fire/Explosion	<ul style="list-style-type: none"> • Upwind 	<ul style="list-style-type: none"> • Site vehicles
Tornado/Severe Weather	<ul style="list-style-type: none"> • Closest available tornado shelter 	<ul style="list-style-type: none"> • Building # (TBD by SSO)
Lightning	<ul style="list-style-type: none"> • Closest available shelter 	<ul style="list-style-type: none"> • Vehicle/Site Trailer
Additional Information		
Communication Procedures	<p>Direct verbal communications; however, must be supplemented anytime voices cannot be clearly perceived above ambient noise levels (e.g., noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight cannot be easily maintained amongst all Resolution Consultants personnel because of distance, terrain, or other obstructions.</p> <p>Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. Resolution Consultants personnel will bring a mobile phone to the site to ensure that communications with local emergency responders is maintained, when necessary.</p>	
CPR/First Aid Trained Personnel	Kate Freeman, Eric Allen	
Site-Specific Spill Response Procedures	Follow NSA Mid-South Spill Response Procedures	

10.1.3 Spill Containment Procedure

Work activities may involve the use of hazardous materials (e.g., fuels, solvents) or work involving drums or other containers. Procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers.
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (e.g., speedy dri) shall be available at each work site (more as needed).



- All hazardous commodities in use (e.g., fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- Drums/containers will be secured and handled in a manner which minimizes spillage and reduces the risk of musculoskeletal injuries.

10.1.4 Safety Accident/Incident Reporting

All accidents and incidents that occur onsite during any field activity will be promptly reported to the SSO and the immediate supervisor.

If any Resolution Consultants employee is injured and requires medical treatment, the Site Supervisor will report the incident in accordance with Resolution Consultants' incident reporting procedures. A copy of the final Supervisor's Report of Incident will be provided to the Resolution Consultants Health and Safety Manager or designee before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 300 or equivalent) must be provided to the SSO within 24 hours after the accident has occurred.

All accidents/incidents will be investigated. Copies of all subcontractor accident investigations will be provided to the SSO within five (5) days of the accident/incident.

10.1.5 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported to Base Security and NSA Environmental will do any further reporting necessary, including state and federal entities.

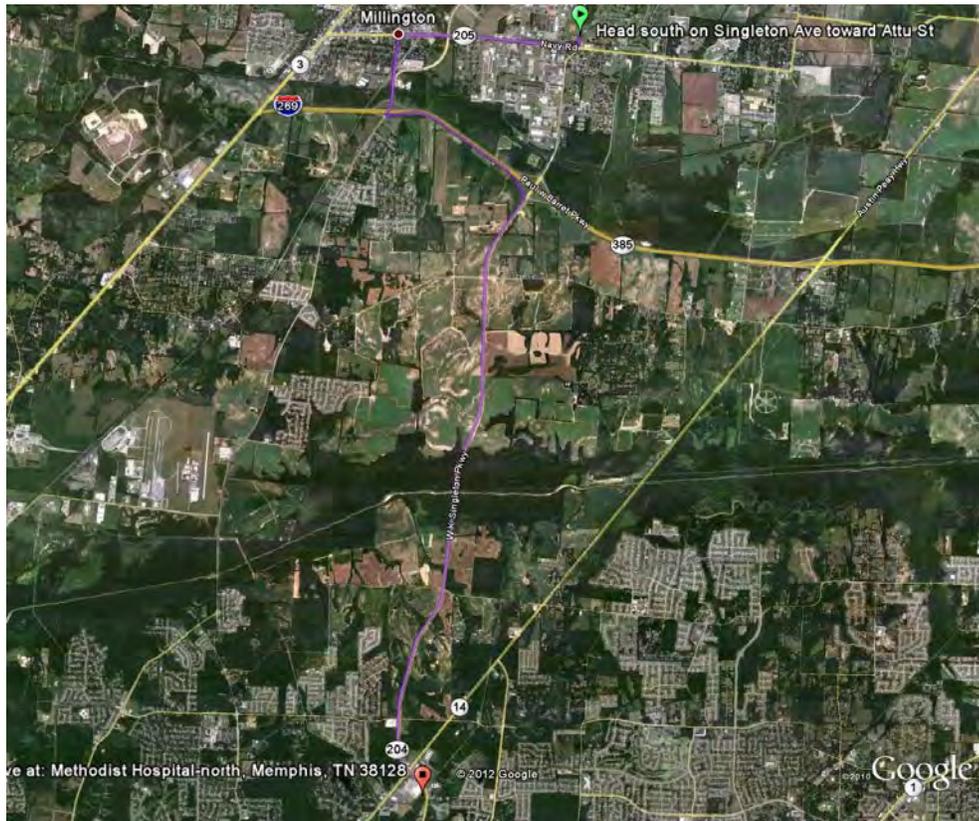


Figure 10-1 — Emergency Occupational Hospital Route/Detail Map

Approximate time: 13 Minutes

From: Naval Support Activity Mid-South 5722 Integrity Drive, Millington, TN 38054-5028

To: Methodist North Hospital 3960 New Covington Pike, Memphis, TN 38128 — 901-516-5200

1. Leaving NSA from the Willis Gate, Turn left onto Navy Road
Go 0.6 miles
2. Turn left onto Veterans Parkway
Go 0.8 miles
3. Continue onto Raleigh Millington Road
Go 0.3 miles
4. Turn left onto the Paul W. Barrett Parkway E ramp
Go 0.3 miles



5. Merge onto I-269 S/Paul W. Barrett Parkway
Go 1.1 miles

6. Take the TN-204 S exit toward NSA
Go 0.3 miles

7. Keep right at the fork, follow signs for Tennessee 204 and merge onto TN-204 S/Singleton
Continue to follow TN-204S
Go 6.2 miles

Destination will be on the left.

Total 9.7 miles

Attachment A
HASP Revision Log

**Site Health and Safety Plan
NSA Mid-South
Revision History**

Revision No.	Revision Date	Approved By (Initials)	Changes, Discussion
0			

Attachment B
Activity Hazard Analyses

Activity Hazard Analysis (AHA)

Activity/Work Task: Mobilization/ Demobilization	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: NSA Mid-South	Risk Assessment Code (RAC) Matrix					
Project Number: JM25	Severity	Probability				
Date Prepared: 10/30/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Eric Allen, CSP/ H&S Specialist	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by (Name/Title): Corey Coleman/ TOM	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.) Seat Belts are to be worn at all times while traveling in vehicles.	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
		M = Moderate Risk		L = Low Risk		
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Maintain 3 points of contact when climbing into vehicle Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				
Driving	<ul style="list-style-type: none"> Communication Accident Prevention 	<ul style="list-style-type: none"> Do not use cellular phones while operating vehicles of any kind. Always wear seatbelt when traveling in the vehicle to and from the site 				L

Job Steps	Hazards	Controls	RAC
Loading and unloading the boat	<ul style="list-style-type: none"> Slip/Trip/Fall Drowning Cuts/Scraps/Bruises 	<ul style="list-style-type: none"> Maintain a clear deck both on and off of the boat, and maintain three points of contact when at all possible. Wear life jacket at all times when loading and unloading the boat. Wear appropriate clothing for the current weather and working conditions. 	L

Additional Safety Considerations
<ol style="list-style-type: none"> Ensure all personnel have read the HASP Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or SOPs. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
05-308, Manual Lifting 05-313, Wildlife, Plants, Insects 05-607, Manual Lifting	LEVEL D <ul style="list-style-type: none"> ANSI approved hard hat ANSI approved safety glasses Shirts with sleeves and full-length pants. ANSI approved steel safety-toe boots or approved equivalent. High visibility reflective traffic vest if near moving vehicles Nitrile Gloves Leather work gloves First aid kit (located in vehicle). Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> N/A

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements

None	None	None
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Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, Resolution Consultants employees agree that:

- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Print Name & Company

Date

Signature

Print Name & Company

Date

Signature

Print Name & Company

Date

Signature

Print Name & Company

Date

Signature

Print Name & Company

Date

Signature

Print Name & Company

Date

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Print Name & Company

Date

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Print Name & Company

Date

Signature

Print Name & Company

Date

Signature

Activity Hazard Analysis (AHA)

Activity/Work Task: Soil Sampling	Overall Risk Assessment Code (RAC) (Use highest code)				L	
Project Location: NSA Mid-South	Risk Assessment Code (RAC) Matrix					
Project Number: F27B	Severity	Probability				
Date Prepared: 10/30/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Eric Allen, CSP/ H&S Specialist	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by (Name/Title): Corey Coleman/ H&S Specialist	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.)	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
		M = Moderate Risk			L = Low Risk	
Job Steps	Hazards	Controls			RAC	
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Maintain 3 points of contact when climbing into vehicle Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 			L	
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				
Establish EZ and unload/set-up equipment	<ul style="list-style-type: none"> Traffic in roadways and parking lots 	<ul style="list-style-type: none"> Use combination of vehicles, cones, traffic barriers and caution tape. A traffic plan may be necessary depending on location. 			L	
	<ul style="list-style-type: none"> Cuts/scrapes 	<ul style="list-style-type: none"> Wear leather gloves. 				

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> Struck by 	<ul style="list-style-type: none"> Exercise caution when moving auger extensions to avoid contact with other objects 	
	<ul style="list-style-type: none"> Stacking heights 	<ul style="list-style-type: none"> Avoid stacking equipment and boxes. 	
IDW handling	<ul style="list-style-type: none"> Chemical Exposure Manual lifting Splash Hazard Spills 	<ul style="list-style-type: none"> Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) Use respiratory protection, depending on measurements. Inspect Drums/Containers prior to use for integrity and contaminants Pour water from buckets into drums/containers as soon as practicable. Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Sample collection and packaging	<ul style="list-style-type: none"> Chemical exposure potential 	<ul style="list-style-type: none"> Follow proper decontamination procedures 	L
	<ul style="list-style-type: none"> Cuts/Scrapes 	<ul style="list-style-type: none"> Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) 	
	<ul style="list-style-type: none"> Manual lifting of equipment 	<ul style="list-style-type: none"> Use proper lifting techniques and do not over-extend 	
Decontamination	<ul style="list-style-type: none"> Chemical exposure potential Cuts/Scrapes Manual lifting of equipment 	<ul style="list-style-type: none"> Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) Have portable eyewash on site Pour water from buckets into drums/containers as soon as practicable and lifting with legs. 	L

Chemical Hazards and Monitoring Procedures	
Chemical Hazard(s) (list):	5.0
Applicable HASP Section(s):	5.0
Monitoring Instrument(s):	PID and Detector Tubes

Additional Safety Considerations
<ol style="list-style-type: none"> Ensure all personnel have read the HASP Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes,

Additional Safety Considerations

stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 508, Hazardous Materials and Sample Shipping SH&E 509, Biological Hazards SH&E 511, Heat Stress SH&E 607, Manual Lifting	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest if near moving vehicles • Nitrile Gloves • Leather work gloves • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
TBD	To be performed by qualified person.	Equipment will be inspected prior to use. Any safety deficiencies detected will require cessation of sampling activities until appropriate repairs have been made.

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- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Print Name & Company

Date

Signature

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Activity Hazard Analysis (AHA)

Activity/Work Task: Unanticipated Work Tasks	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: NSA Mid-South	Risk Assessment Code (RAC) Matrix					
Project Number: JM25	Severity	Probability				
Date Prepared: 10/30/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Eric Allen, CSP/ H&S Specialist	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by (Name/Title): Corey Coleman/ TOM	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.)		<p>Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)</p> <p>"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.</p>				
					RAC Chart	
					E = Extremely High Risk	
					H = High Risk	
					M = Moderate Risk	
					L = Low Risk	
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Maintain 3 points of contact when climbing into vehicle Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				

Job Steps	Hazards	Controls	RAC
			L

Additional Safety Considerations
<ol style="list-style-type: none"> 1. Ensure all personnel have read the HASP 2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs. BC). 3. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. 4. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or SOPs. 5. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle. 6. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. 7. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting. 8. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
05-308, Manual Lifting 05-313, Wildlife, Plants, Insects 05-607, Manual Lifting	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest if near moving vehicles • Nitrile Gloves • Leather work gloves • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> •N/A

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
None	None	None

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- I will ensure compliance with my company's policies on health and safety.

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Activity Hazard Analysis (AHA)

Activity/Work Task: Well Installation Oversight	Overall Risk Assessment Code (RAC) (Use highest code)	M				
Project Location: NSA Mid-South	Risk Assessment Code (RAC) Matrix					
Project Number: F27B	Severity	Probability				
Date Prepared: 10/30/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Eric Allen, CSP/ H&S Specialist	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by (Name/Title): Corey Coleman/ Project Manager	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.)	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
M = Moderate Risk						
L = Low Risk						
Recommended PPE:						
<input checked="" type="checkbox"/> Safety Glasses With Side shields <input checked="" type="checkbox"/> Steel-Toed Boots <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Nitrile Gloves <input type="checkbox"/> Leather Gloves <input checked="" type="checkbox"/> Hearing Protection <input type="checkbox"/> Flame Retardant Clothing						
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				

Job Steps	Hazards	Controls	RAC
Mobilization / Site Set Up	<ul style="list-style-type: none"> Slips, Trips, Falls 	<ul style="list-style-type: none"> Clear trees, roots, weeds, limbs and other ground hazards from the drilling location. Practice good housekeeping to keep the ground around the drilling site clear of obstructions, equipment, and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	L
	<ul style="list-style-type: none"> General equipment hazards <ul style="list-style-type: none"> Overhead and underground utilities Noise Hazard Pinch points/swing radius Chemical exposure potential Eye Injury Fire 	<ul style="list-style-type: none"> All equipment will be properly secured during transport. All vehicles and equipment will comply with DOT requirements. Never move the DPT rig with the mast upright. Ensure the sampling site foundation is stable and as level as possible. Use a ground guide along with a functioning back-up alarm during equipment backing. Confirm Utility Locations Inspect vehicles and equipment daily (Checklists provided in HASP) Maintain clean and organized work area. Wear appropriate clothing and PPE, (no loose clothing or jewelry) Earplugs and/or ear muffs required in EZ Position the drill rig and personnel up wind of drilling location Monitoring breathing zone with PID and upgrade PPE as required. Avoid creating splash hazards while drilling. Keep a safe distance from drill rig. Use hand signals, keep clear of moving equipment, and ensure eye contact with operator prior to approaching. Have fire extinguisher on site. 	
	<ul style="list-style-type: none"> Contact with utilities 	<ul style="list-style-type: none"> Inspect for buried and overhead utilities in the vicinity of the drilling location. Clearance will be required, as stipulated in the HASP. 	
	<ul style="list-style-type: none"> Traffic in adjacent roadway 	<ul style="list-style-type: none"> Use combination of vehicles, cones, traffic barriers, and caution tape 	
Boring Process	<ul style="list-style-type: none"> Cuts 	<ul style="list-style-type: none"> Wear appropriate work gloves to prevent cuts, lacerations 	M
	<ul style="list-style-type: none"> Dermal Contact 	<ul style="list-style-type: none"> Wear appropriate protective clothing to avoid dermal or personal clothing contact with sampled material. 	

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> Slips, Trips, Falls 	<ul style="list-style-type: none"> Clear trees, roots, weeds, limbs and other ground hazards from the drilling location. Practice good housekeeping to keep the ground around the drilling site clear of obstructions, equipment and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	
	<ul style="list-style-type: none"> Volatile Organic Compounds (VOCs) 	<ul style="list-style-type: none"> If the results of previous surveys indicate the presence of VOCs in hazardous levels, rig operators should be prepared to protect both personnel and equipment from VOC inhalation and flammable atmospheres. 	
Sample collection and packaging	<ul style="list-style-type: none"> Chemical exposure potential 	<ul style="list-style-type: none"> Follow proper decontamination procedures 	L
	<ul style="list-style-type: none"> Cuts/Scrapes 	<ul style="list-style-type: none"> Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) 	
	<ul style="list-style-type: none"> Manual lifting of equipment 	<ul style="list-style-type: none"> Use proper lifting techniques and do not over-extend 	
Rig decontamination	<ul style="list-style-type: none"> High pressure water Splash Hazard 	<ul style="list-style-type: none"> Spray away from body Wear full-face shield, gloves, rubber boots, and Tyvek or other suitable attire. 	L

Chemical Hazards and Monitoring Procedures	
Chemical Hazard(s) (list):	VOC, BTEX
Applicable HASP Section(s):	5.0
Monitoring Instrument(s):	PID and Benzene colormetric tubes

Additional Safety Considerations
<ol style="list-style-type: none"> Ensure all personnel have read the HASP Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure equipment has a working kill switch and back-up alarms, and follow equipment inspection procedures. Ensure underground utilities are verified with facility, marked, markings maintained, and operator aware of location All equipment operators must be Competent Persons for the task/equipment being performed/operated. All ground personnel must stay clear of equipment and make eye contact (and receive confirmation) with operator prior to approaching. Wear high visibility reflective vests and stay out of travel lanes and swing radius of heavy equipment. Dust hazard are expected to be minimal due to saturated state of soils and regular precipitation. If visible emissions of dust observed, then dust suppression techniques will be implemented. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or SOPs. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.

Additional Safety Considerations

11. Conduct equipment inspection of all hoses and switches. Stay clear of running equipment.
12. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
13. Stay clear of moving rig, do not move rig with mast raised, do not drive on slopes greater than 30 degrees, avoid soft areas when moving rig and setting up, chock wheels. Use spotter when moving rig, check for overhead obstructions.
14. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.
15. For equipment decontamination, triple rinse using distilled or deionized water andalconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 405, Drilling and Boring SH&E 406, Overhead Electrical Lines SH&E 417, Identifying Underground Utilities SH&E 508, Hazardous Materials and Sample Shipping SH&E 511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest • Nitrile Gloves • Leather work gloves • Hearing protection required when around operating machines (85 dBA). • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Drill Rig	Drilling to be performed by competent person as certified by employer.	Equipment will be inspected daily by drill rig operator. Any safety deficiencies detected will require cessation of sampling activities until appropriate repairs have been made.

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- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Activity Hazard Analysis (AHA)

Activity/Work Task: Groundwater Sampling, Monitoring Wells	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: NSA Mid-South	Risk Assessment Code (RAC) Matrix					
Project Number: F27B	Severity	Probability				
Date Prepared: 10/30/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Eric Allen, CSP/ H&S Specialist	Catastrophic	E	E	H	H	M
Reviewed by (Name/Title): Corey Coleman/ TOM	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.)	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
					M = Moderate Risk	
					L = Low Risk	
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Maintain 3 points of contact when climbing into vehicle Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				
Establish work area around well and unload/set-up equipment	<ul style="list-style-type: none"> Traffic in roadways and parking lots 	<ul style="list-style-type: none"> Use combination of vehicles, cones, traffic barriers and caution tape. A traffic plan may be necessary depending on location. 				L
	<ul style="list-style-type: none"> Cuts/scrapes 	<ul style="list-style-type: none"> Wear leather gloves. 				

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> Stacking heights 	<ul style="list-style-type: none"> Avoid stacking equipment and boxes. 	
Open well and take water level measurement.	<ul style="list-style-type: none"> Cuts/scrapes Biological Hazards Exposure potential 	<ul style="list-style-type: none"> Wear leather gloves when un-bolting well lid Look for spiders, scorpions, etc. in the well head. Use ventilation procedures on each well, monitoring at well head and breathing zone. Use respiratory protection, depending on measurements. Wear nitrile gloves to remove plug and taking measurement. 	L
Sample/develop purge using a bailer or pump Well will be purged prior to sampling.	<ul style="list-style-type: none"> Exposure potential Cuts/scrapes Electrical Manual lifting 	<ul style="list-style-type: none"> Wear nitrile gloves while taking flow rates Monitor breathing zone continuously during sampling event. Use respiratory protection, depending on measurements. Ensure employees are properly trained in the use of the compressors, e.g., use correct contacts for 12 volt batteries and avoid arcing situations Use proper lifting techniques and ergonomics awareness. Use appropriate cutting devices for tubing boxes and proper tools for pump repairs/maintenance. 	L
IDW handling	<ul style="list-style-type: none"> Chemical Exposure Manual lifting Splash Hazard Spills 	<ul style="list-style-type: none"> Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) Use respiratory protection, depending on measurements. Have portable eyewash on site Inspect Drums/Containers prior to use for integrity and contaminants Pour water from buckets into drums/containers as soon as practicable. Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Sample collection and packaging	<ul style="list-style-type: none"> Chemical exposure potential 	<ul style="list-style-type: none"> Follow proper decontamination procedures 	L
	<ul style="list-style-type: none"> Cuts/Scrapes 	<ul style="list-style-type: none"> Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) 	
	<ul style="list-style-type: none"> Manual lifting of equipment 	<ul style="list-style-type: none"> Use proper lifting techniques and do not over-extend 	
Decontamination	<ul style="list-style-type: none"> Chemical exposure potential Cuts/Scrapes Manual lifting of equipment 	<ul style="list-style-type: none"> Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) Have portable eyewash on site Pour water from buckets into drums/containers as soon as practicable and lifting with legs. 	L

Chemical Hazards and Monitoring Procedures

Chemical Hazard(s) (list):	VOC, BTEX
Applicable HASP Section(s):	5.0
Monitoring Instrument(s):	PID

Additional Safety Considerations

1. Ensure all personnel have read the HASP
2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC).
3. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path.
4. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or SOPs.
5. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle.
6. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
7. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
8. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
05-305, Hand & Power Tools 05-308, Manual Lifting 05-313, Wildlife, Plants, Insects 05-508, Hazardous Materials and Sample Shipping 50-511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest if near moving vehicles • Nitrile Gloves • Leather work gloves • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
TBD	TBD	TBD

Acknowledgement

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By signing this form, subcontractors and visitors agree that:

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Attachment C
Standard Operating Procedures

5-208-Personal Protective Equipment Program

1.0 Purpose and Scope

- 1.1 Provide an effective Personal Protective Equipment (PPE) Program to protect Resolution employees from potential workplace safety and health hazards.
- 1.2 This procedure applies to all Resolution employees and operations.
- 1.3 The proper use of appropriate PPE, in combination with effective engineering and administrative controls, can provide Resolution employees with protection against potential workplace hazards and can reduce the potential for workplace injury and illness.

2.0 Terms and Definitions

- 2.1 **PPE:** Personal Protective Equipment
- 2.2 **ANSI:** American National Standards Institute

3.0 References

- 3.1 Occupational Safety and Health Administration (OSHA) PPE standard (29 CFR 1910.132) requires Resolution to assess workplace(s) to determine if hazards that necessitate the use of PPE exist in the workplace, and, if such hazards are present, to
 - 3.1.1 Select the appropriate types of PPE and
 - 3.1.2 Provide employees with training about the use and care of the selected PPE.

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Regional SH&E Professional

- Provide guidance to Project Managers, Field Task Managers, Supervisors, and field staff on the assessment of hazards and the selection of PPE.
- Provide training materials to Project Managers, Field Task Managers and Supervisors for employee training.

4.1.2 Project Managers (Field Task Managers, Supervisors)

- Conduct Hazard Assessments to identify hazards present and to specify PPE appropriate for those hazards.
- Determine which of your staff members will require employee-issued PPE.
- Approve the purchase of company-issued PPE.
- Verify that appropriate PPE is utilized by your employees when required or necessary.

4.1.3 Employee

- In accordance with your training and instructions, utilize appropriate PPE that has been issued to them when required or necessary.
- Inspect your PPE prior to use to confirm that it is functional, and maintain your PPE in a clean and functional condition.
- Follow instructions and manufacturers' guidance on the care, use, and storage of your PPE.
- Prior to using any type of PPE, confirm that it is in good shape, free of dirt and debris, and that you are familiar with its correct use. Always make sure PPE fits adequately to perform the use intended.
- Refrain from wearing PPE outside of the work area for which it is required if doing so would constitute a hazard.

4.2 **Hazard Assessment for Office Locations**

Office Hazard Analysis will be completed for applicable tasks as required in 29 CFR 1910.132 following the guidelines as specified in OSHA Pamphlet 3151-12R 2003 (Personal Protective Equipment),

4.3 **Hazard Assessment for Off-Site Locations**

4.3.1 HAZWOPER Locations

- Each Health and Safety Plan (HASP) that is prepared for waste site investigations/remediation includes a hazard assessment for each proposed field activity. Task-specific PPE requirements are listed in the HASP. Therefore, the HASP will serve as the certificate of hazard assessment for each project that involves off-site work activities that require the use of PPE.

4.3.2 All Other Off-Site Locations

- The Task Hazard Analysis will serve as the certificate of hazard assessment for projects that involves offsite work activities that require the use of PPE. The checklist will be reviewed with the entire field team prior to arriving at the site.

4.4 **Training**

4.4.1 Staff will receive adequate instruction on the correct use, limitations, and assigned maintenance duties for the equipment to be used. The following information, at a minimum, will be covered during PPE training:

- What PPE is required.
- When it is required.
- Why it is required.
- How to properly don, doff, adjust, and wear the PPE described.
- The limitations of the PPE, including its expected useful life.
- How to properly care for, maintain, and dispose of the PPE.

4.4.2 Field staff are responsible for confirming that they have reviewed the operation manual for the PPE before work commences.

4.4.3 All staff will receive an orientation to the hazards on the job site as well as initial Field Safety orientation that outlines appropriate PPE requirements.

4.4.4 Resolution Consultants employees who have participated in the 40-hour HAZWOPER training course are considered to have met the employee training requirements of the PPE standard. The training certificates that are issued as documentation of successful completion of the 40-hour HAZWOPER course will also serve as documentation of training as required by the PPE standard. Employees who have not participated in the HAZWOPER training will be provided PPE training specific to your assignment and/or location. The PPE Facts Sheets (attached) can serve as the basis for training.

4.5 **Determining the Need for PPE**

4.5.1 Using the Task Hazard Assessment or HASP, the need for the following types of PPE will be evaluated.

4.5.2 PPE will:

- Be selected and used in accordance with recognized standards and provide effective protection.
- Not in itself create a hazard to the wearer.
- Be compatible, so that one item of PPE does not make another item ineffective.
- Be maintained in good working order and in a sanitary condition.

- 4.5.3 Prior to entering any regulated work area, confirm that you have access to or are equipped with the following CSA-approved PPE, appropriate to the site hazards:
- Head Protection
 - Eye & Face Protection
 - Foot Protection
 - Hi-Visibility Vests
 - Hearing Protection
- 4.5.4 After the hazard assessments have been completed, the Project Manager will select the appropriate PPE for each job category or task, as necessary. The selected equipment will be indicated on the hazard assessment. PPE will be provided to each employee appropriate for the hazards present. All PPE selected and purchased by Resolution will meet or exceed the American National Standards Institute (ANSI) standards, Canadian Standards Association (CSA) standards, or other standards as dictated by provincial, territorial, or state legislation.
- 4.6 **Eye and Face Protection**
- 4.6.1 The OSHA standard requires that Resolution employees use appropriate eye and face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acid and caustic liquids, chemical gases or vapors, and injurious light radiation. The standard further requires that eye protection provide side protection when there is a hazard from flying objects.
- 4.7 **Head Protection**
- 4.7.1 Protective helmets (hard hats) are required when employees are working in areas where there is a potential for falling objects to cause injury to the head. When working near exposed electrical conductors that could contact the head, helmets designed to reduce electrical shock will be worn.
- 4.8 **Foot Protection**
- 4.8.1 Protective footwear is required when employees are working in areas where there is a danger of foot injuries from falling and rolling objects or from objects piercing the sole and where an employee's feet are exposed to electrical hazards.
- 4.9 **Hand Protection**
- 4.9.1 Appropriate hand protection is required when employee's hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts and lacerations, severe abrasions, punctures, chemical burns, thermal burns, or harmful temperature extremes.
- 4.9.2 Chemically Resistant Clothing
- 4.9.3 Chemically resistant clothing is required when there is significant potential for the employee to come in direct contact with the chemicals he/she is handling. Tasks that involve chemical handling will be evaluated for the potential of splashing or spilling.
- 4.9.4 High-Visibility Apparel
- 4.9.5 High-visibility apparel with reflective banding (ANSI Class II and III garment) is required for all field activities in close proximity to moving traffic and other modes of transportation (transit, airlines, marine, etc.), in proximity to heavy equipment operations, or whenever otherwise specified in a project HASP. Color of apparel (orange or lime) may be client/project-specific.
- 4.10 **Personal Clothing**
- 4.10.1 For personal safety on the job site, do not wear
- Loose or unsecured clothing or loose fitting cuffs.
 - Greasy or oily clothing, gloves, or boots.
 - Torn or ragged clothing.

- 4.10.2 Neck chains are hazardous and will be worn under clothing so that they do not hang out. Long hair will be tied back or otherwise confined.
- 4.10.3 Clothing made of synthetic fibres can be readily ignited and melted by electric flash or extreme heat sources. Cotton or wool fabrics are recommended for general use.
- 4.11 **Specialized PPE**
- 4.11.1 In addition to basic PPE, additional specialized PPE may be required to provide appropriate protection to the employee. Refer to applicable OH&S legislation and related Standard Operating Procedures for additional information on PPE requirements.
- Fall Protection: Only full body harnesses with shock-absorbing lanyards will be used for personal fall arrest.
 - Respiratory Protection: Respiratory protection shall be selected based on the contaminant and concentration to which the employee will be exposed. Refer to 5-519 *Respiratory Protection Program* and the task- or project-specific Baseline Hazard Assessments for specific requirements.
 - Fire Resistant Clothing: Approved fire resistant outer clothing may be required at work locations with flammable or explosive materials or environments.
 - Other Head Protection: Operators and passengers (if permitted) of all terrain vehicles and snowmobiles will wear approved helmets.
 - Chemical Protective Clothing: Approved chemical protection appropriate to the hazard will be worn. Review applicable Material Safety Data Sheets (MSDSs) for appropriate PPE.
 - Protection from Drowning: Employees being transported by boat are required to wear life jackets. Employees exposed to any other drowning hazards are required to wear personal flotation devices. Life jackets and personal flotation devices will have the proper regulatory approval.
- 4.12 **PPE Supplies**
- 4.12.1 Each Resolution office will maintain a supply of safety equipment including safety glasses, gloves, and chemically resistant clothing based on the nature of their field activities. The Office Manager or designee will be responsible for maintaining this inventory. PPE that is required for large field efforts will be ordered by the Project Manager or their designee.
- 4.12.2 At a minimum, the office will review its PPE program annually.
- 4.13 **Obtaining Personalized Safety Gear**
- 4.13.1 The OSHA standard in 29 CFR 1910 - Subpart I / 29 CFR 1926 requires that protective equipment, including PPE for eyes, face, head, and extremities, protective clothing, and respiratory devices, be provided to employees wherever necessary by reason of hazards.
- 4.13.2 Employees are not expected to provide their own general PPE. Although each Resolution office stocks and issues various general issue safety gear such as hard hats, plain safety glasses, disposable gloves and coveralls, fall protection, and hearing protection, certain personalized safety gear such as prescription safety glasses, safety-toed (capped) boots, and cotton coveralls will be ordered and sized specifically for the user.
- 4.13.3 Most PPE will be provided to the employee at no charge, with the exception of the above personalized safety equipment (safety glasses, safety toed boots, washable coveralls). A partial cost reimbursement to the employee may be made based on legacy company practice or project stipulations.
- 4.13.4 Prescription Safety Glasses
- As with all hazards, staff will be notified of their potential for injury and will be provided with the appropriate PPE. If wearing contact lenses poses a hazard to the worker's eyes during work, the worker will be advised of the hazards and the alternatives to wearing contact lenses.
 - Eligibility

- Employees will wear safety glasses during activities that involve exposure to eye hazards such as flying particles, chemical splash, or certain types of radiation such as ultraviolet light from welding operations. Typically, the following types of field activities will require the use of safety glasses:
 - Site investigation or remediation and construction activities.
 - Stack monitoring and other types of air emissions monitoring.
 - Audits and assessments in industrial or manufacturing facilities.
 - Activities conducted within laboratories.
 - Activities at client facilities where safety glasses are required.
- Eligibility to obtain prescription safety glasses will be determined by the employee's supervisor based upon the guidance above.
- Procurement of Prescription Safety Glasses
 - Except for eye examinations, associated prescription eyewear costs will be paid by Resolution. The employee may be asked to pay an optician's dispensing fee, which may be submitted on an expense report for reimbursement. Because eye examinations are not covered, employees who have had recent eye examinations should contact the eye care professional in advance to determine their procedure for handling a current prescription.
 - Employees who are eligible will be allowed to order one pair of prescription safety glasses every other year from the selection of glasses offered by the program.
 - Contact the Regional SH&E Professional for guidance on the procurement of prescription safety glasses.

4.13.5 Safety Toed Boots/Shoes

- Eligibility
 - Employees will wear safety boots/shoes during activities that pose the potential for foot injury from dropped objects or penetrations through the sole. Typically, safety toed boots/shoes will be required for the same type of activities, with the exception of laboratory activities, for which safety glasses are required. In addition, work around all types of heavy equipment will typically require the use of safety shoes.
 - Eligibility to obtain safety shoes will be determined by the employee's supervisor based upon the guidance above.
- Procurement of Safety Shoes
 - Eligible employees will be allowed to purchase one pair of safety shoes every other year.
 - Employees who have been authorized to purchase safety shoes by their supervisor should consult the Regional SH&E Manager for obtaining for detailed instructions on how and where to purchase the equipment. The style chosen (i.e., boot or shoe) should be determined based upon the application. For example, low cut shoes may be appropriate for audits and assessments in light industry applications, while safety boots will be more appropriate for environmental remediation, construction, and heavy industry work with significant foot hazards. Before purchasing, the employee is required to verify that the safety boots or shoes meet the specifications above.
 - After the purchase, an employee expense report, including a dated receipt for the shoes, should be submitted for approval and reimbursement. Resolution will reimburse the employee up to a amount that is specified by the SH&E Department or Regional Operations management.

4.13.6 Reusable Coveralls

- Eligibility

- Reusable cotton (or some other washable fabric) coveralls may be made available to employees who regularly perform field work based on conditions. Coveralls can be worn over personal clothing to help protect and keep them clean.
- Eligibility to obtain washable coveralls will be determined by the employee's supervisor based upon the guidance above.

5.0 Records

None.

6.0 Attachments

None.

5-305- Hand and Power Tools

1.0 Purpose and Scope

- 1.1 This procedure provides Resolution Consultants' requirements for all manually-operated hand and power tools and equipment use, handling and storage.
- 1.2 Applies to all Resolution Consultants staff and field worksites.

2.0 Terms and Definitions

None.

3.0 References

- 3.1 5-305-Hand and Power Tools
- 3.2 5-410-Hazardous Energy Control
- 3.3 5-302-Electrical, General
- 3.4 5-208-Personal Protective Equipment Program
- 3.5 5-510-Hearing Conservation Program

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 **Project Manager (Field Task Manager, Supervisor)** Each Manager/Supervisor must ensure that all aspects of this procedure are followed and adhered to on all Resolution Consultants projects, sites and locations. If a specific tool is not included in this work instruction section of this SOP, appropriate guidelines shall be established prior to work associated with that equipment, including following manufacturer's recommendations.
- 4.1.2 **Regional SH&E Professionals** provides technical guidance and support as to this procedure.
- 4.1.3 **Employees** shall not work with any tool that they are not familiar with without first obtaining training associated with that equipment. In addition, employees must following manufacturer's recommendations for its use and must not modify the equipment without first obtaining authorization from the manufacturer..

4.2 Restrictions

- 4.2.1 No employee shall use any hand tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.
- 4.2.2 All tools will be used in accordance with manufacturer's specifications. Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

4.3 Training

- 4.3.1 Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.

4.4 Personal Protective Equipment

- 4.4.1 Lockout devices (padlocks, multiple lock hasps, tags), gloves appropriate to the task, safety-toed boots, as required, hard hats and eye & face protection, as required.

4.5 Inspections

- 4.5.1 All tools must be inspected prior to each use. Any tool that is defective or has missing parts must not be used. Every broken or defective tool must be tagged or identified as such. Tagged tools will be returned to your supervisor for repair or replacement. Tagged tools will be immediately removed from service.
- 4.5.2 All tools must be inspected to manufacture's specifications according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly.

5.0 Records

None.

6.0 Attachments

None.

7.0 Records

None.

8.0 Attachments

None.

5-306-Highway and Road Work

1.0 Purpose and Scope

- 1.1 To address potential hazards that may occur during highway construction and during work within the right of way of a public or private roadway.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 **Personal Protective Equipment (PPE):** Safety clothing and equipment worn by workers in traffic areas to provide protection and heightened visibility from physical hazards including moving vehicles and construction equipment.
- 2.2 **Traffic areas:** Any work area where workers are located within 20 feet of moving traffic, existing or anticipated.
- 2.3 **Traffic Control Plan:** A written document containing drawings and text that describes the physical controls to be established to isolate workers from moving vehicles.
- 2.4 **WOF:** Workers on foot.

3.0 References

- 3.1 None.

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 **Project/Lead Manager or Resident Engineer** is responsible for administering the procedure and for determining the measures and configuration of the temporary traffic control zone in accordance with specifications for workers, motorists, and pedestrians and the protection of Resolution Consultants employees within the contract. The Lead Manager will also see that employees assigned to work in traffic areas are trained in the use of traffic control systems and PPE.
- 4.1.2 **Site Safety Coordinator** is responsible to the lead manager for the implementation of safety and the internal traffic control plan within a highway construction/demolition worksite. The Site Safety Coordinator will
 - Be responsible for traffic safety coordination on office projects.
 - Be appointed by each office that has any field work involving Resolution Consultants staff working in or near traffic. This is not a dedicated role and may be a committee member.
 - Receive training in the requirements of the governing transportation authority and the applicable OH&S legislation through training sanctioned by the respective authorities.
 - Be involved in conducting hazard assessments, developing the mitigating strategies and Safe Job Procedures, and reviewing their implementation for any project where traffic is identified as a hazard to our team members.

4.2 Personal Protective Equipment

- 4.2.1 High visibility safety vest /apparel
- 4.2.2 Retro-reflective stripes (for night work)
- 4.2.3 Protective headwear (hard hat)
- 4.2.4 Two-way radio or other means of effective communication

- 4.2.5 Traffic Accommodation equipment, as required by the traffic protection plan:
- A rooftop beacon light for the vehicle, where required
 - Pylons, Glo-posts, flags, barricades and/or flagging tape, warning lights, flashing light boards
 - Signage
 - Flagging equipment, as required:
 - Daytime:
 - Flag person's "Stop and Slow" paddle
 - A blaze orange flag person's vest over white coveralls
 - Safety head protection (hard hat)
 - Drinking water
 - Bug repellent and/or sun screen as conditions warrant
 - Optional radio communication (if required)
 - Night time (additional requirements):
 - A retro-reflective "Stop and Slow" paddle
 - A flashlight fitted with a red signaling baton
 - Flashing yellow beacons set up in advance of the flag person
- 4.3 **Restrictions**
- 4.3.1 Applicable legislated requirements governing all aspects of traffic safety, including directing traffic, signage, PPE, traffic control devices in temporary construction, maintenance and utility work zones, will be reviewed in preparation for the site-specific traffic accommodation.
- 4.3.2 No personnel will be allowed onto the site without first reviewing the project-specific traffic protection plan.
- 4.4 **Training**
- 4.4.1 All staff will receive on-site orientation to the hazards and controls.
- 4.4.2 Only staff with appropriate flag person training will act as a flag person.
- 4.5 **Traffic Control Plan**
- 4.5.1 Transportation incidents and workers struck by vehicles or mobile equipment account for many fatal construction work injuries. Workers in highway construction activities including flagging, demolition, surveying, utility, clean-up, emergency responders, and others in areas where traffic exists are exposed to being struck by moving vehicles. Work zones are used to move traffic in an approved direction and are typically identified by signs, cones, barrels, and barriers.
- 4.5.2 The procedures appropriate for work in traffic areas will vary depending on the work environment. Very simple procedures are needed in an inactive parking lot, and more complex procedures are needed when working in a construction zone on a highway. Each Resolution Consultants project team shall prepare a project Health and Safety Plan (HASP) or Safe Work Plan (SWP) addressing traffic controls and worker protection appropriate for the team's project and exposures. Plans shall address the following if applicable:
- Attenuator vehicles
 - Closures within a closure
 - Communications
 - Driving: seatbelts and rollover protection should be used on equipment and vehicles as stated by the manufacturer
 - Night operations and work within traffic controls

- PPE
 - Sanitation
 - Signage
 - Traffic control devices
 - Traffic control plans and permits
 - Training
 - Work zone protections: various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck mounted attenuators are available to limit motorist intrusions into the construction work zone
 - Worker: heavy equipment interface
- 4.5.3 A Traffic Control Plan will be completed for the movement of vehicles in areas where workers are conducting other tasks.
- 4.5.4 Drivers, workers on foot (WOF), and pedestrians will be able to see and understand the routes they are to follow.
- 4.5.5 Where there are several projects, coordinated vehicle routes and communication between contractors will reduce vehicular struck-by incidents.
- 4.5.6 Hazard identification and plan development shall be performed in accordance with this procedure. The plans shall include the identification of the responsibility for personnel and implementation of the safety program under highway construction activities.
- 4.5.7 Other requirements for supporting activities such as excavations, heavy equipment usage, personal protective equipment, etc. shall be applicable and addressed in accordance with other Standard Operating Procedures.
- A traffic protection plan will be an integral part of the HASP or SWP whenever staff will be exposed to the hazards of vehicular traffic during project work (this may include surveys, drilling and soils inspections, bridge or overpass inspections, inspection of roadway construction projects).
 - Work duration, road width, and traffic volume are some of the key considerations to be contemplated when designing a traffic protection plan. The traffic protection plan will address the specific vehicular hazards and describe the measures that will be implemented to protect employees.
 - Traffic accommodation plans will be developed in consultation with a qualified supervisor or manager experienced in traffic control. In addition, a supervisor will be designated to oversee the implementation of the protection plan until work is completed.
 - OH&S regulations and associated standards or guidebooks provide instruction on the use of traffic control devices in temporary construction, maintenance, and utility work zones for worker and motorist safety and to minimize the disruption of traffic flow.
 - Schedule work to avoid periods of heavy traffic.
 - Alert traffic of work ahead, by placing signs or cones well ahead of the work area.
 - If the work area is being managed under a Traffic Control Plan or Traffic Accommodation Plan, obtain copies of these plans before commencing work.
 - Traffic accommodation that is adequate in good weather conditions and daylight may not be adequate under adverse weather conditions and/or hours of darkness. Reassess the accommodation based on conditions.
 - Traffic accommodation will be planned to provide safe conditions for the protection and safe passage of motorists, pedestrians, and employees at all work sites. It will include all areas located within the traveled portion of a roadway including shoulders, ditches, and boulevards.

4.6 **Short-Term Traffic Protection**

- 4.6.1 Always wear the appropriate PPE to maintain your visibility to vehicular traffic. Wear a tear-away fluorescent reflective vest (and retro-reflective stripes on the arms and legs for night work or during periods of limited visibility) at all times.
- 4.6.2 Pull your vehicles off as far to the right of the traveled portion of the road as possible. Confirm that the shoulder of the highway or street where you will park your vehicle is wide enough to allow for safe access to and egress from the vehicle.
- 4.6.3 Always park your vehicle at least 30 metres from the flag person station. The vehicle should be positioned between the flag person and the work crew.
- 4.6.4 Activate the four-way flashers for your vehicle prior to exiting the vehicle.
- 4.6.5 Plan an escape route prior to exiting the vehicle.
- 4.6.6 Load and unload materials or equipment from the passenger side of the vehicle.
- 4.6.7 Avoid turning your back to oncoming traffic.
- 4.6.8 Be aware of mobile equipment that may be operating in the work area.
- 4.6.9 Do not enter onto the traveled portion of the road except to cross the road. Road crossings should be made at a 90 degree angle to the direction of the road.

4.7 **Long-Term Traffic Protection**

- 4.7.1 Traffic accommodation will be provided BEFORE the work starts and will be maintained until the work is completed. This may mean 24 hours a day, 7 days a week.
- 4.7.2 Generally, for long-term duration work activities that are performed at construction projects, the Constructor for the project is required to develop a traffic protection plan.
- 4.7.3 If Resolution Consultants has assumed the role of Constructor for the project, the traffic protection plan will be developed and implemented prior to the commencement of work activities at the project.
- 4.7.4 If Resolution Consultants is not the Constructor for the project, the traffic protection plan for the project will be developed by our Client or a Constructor designated by the Client.
- 4.7.5 The traffic protection plan should be reviewed with Resolution Consultants employees during orientation to the Project. If the traffic protection plan is not discussed at the project-specific orientation, employees should discuss the issue with the Site Supervisor or Client contact for the Project.

4.8 **Signage**

- 4.8.1 Standard highway signs for information, speed limits, and work zones will assist drivers in identifying designated traffic paths.
- 4.8.2 Provide appropriate instructional signage such as: EVACUATION ROUTE; DO NOT ENTER; REDUCED SPEED AHEAD; ROAD CLOSED; and NO OUTLET.
- 4.8.3 Using standard highway signs for internal construction worksite traffic control will assist workers in recognizing the route they are to use at the construction site.
- 4.8.4 Traffic Signs
 - Signage will be of acceptable standards, in good condition, clean, legible, and suited to the purpose.
 - Signage will be secured or weighted.
 - Routinely inspect signage for placement, cleanliness, and physical damage.
 - Cover road traffic control signage when no activity is present.

4.9 **Traffic Control Devices**

- 4.9.1 Standard traffic control devices, signals, and message boards will instruct drivers to follow a path away from where work is being done.

- 4.9.2 The authority in charge will determine the approved traffic control devices such as cones, barrels, barricades, and delineator posts that will be used as part of the traffic control plan.
- 4.9.3 These standard devices should also be used inside the work zone.
- 4.10 **Work Zone Protections**
- 4.10.1 Various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck-mounted attenuators shall be used to limit motorist intrusions into the construction work zone, as appropriate.
- 4.10.2 All Resolution Consultants staff shall be made aware of controls established by the Contractor.
- 4.10.3 Resolution Consultants staff shall wear the required safety equipment at all times including a hard hat, work boots, eye protection, and a high-visibility safety vest as a minimum and shall observe all project rules and requirements.
- 4.10.4 In the absence of a contractor, when Resolution Consultants staff are in the field alone—e.g., investigations, surveys—all appropriate DOT traffic control standards and devices shall be observed and placed in position.
- 4.10.5 The work zone shall be made safe by its separation from traffic.
- 4.11 **Flagging**
- 4.11.1 Flaggers and others providing temporary traffic control will wear high visibility clothing with a background of fluorescent yellow-green or orange-red and white, silver, yellow-green, orange, or yellow retro-reflective material.
- 4.11.2 In areas of traffic movement, PPE will make the worker visible for at least 1,000 feet so that the worker can be seen from any direction and will make the worker stand out from the background. Check the label or packaging to confirm that the garments are performance Class 2 or 3 (class requirement may be project-specific).
- 4.11.3 Drivers should be warned in advance with signs that there will be a flagger ahead.
- 4.11.4 Flaggers should use STOP/SLOW paddles, paddles with lights, or flags (flags should be used only in emergencies.). The STOP sign should be octagonal with a red background and white letters and border. The SLOW sign should be octagonal with an orange background and black letters and a border.
- 4.11.5 **Flag Persons**
- A traffic control person (flag person) will stand in a safe position, preferably on the driver's side of the lane under control, be clearly visible, have an unobstructed view of approaching traffic, and be positioned at least 25 m (80 ft) away from the work area unless circumstances or space requirements, such as working at or near an intersection, dictate otherwise.
 - Flag persons will be trained and competent and will use appropriate PPE.
 - Flag persons will be instructed in traffic control and flagging procedures, will be provided with sufficient breaks, and will not be permitted to work alone for extended periods as per local regulations.
 - Flag persons will not get involved in needless conversation and will stay alert at their points of duty until relieved.
 - Except for brief flagging operations, or in an emergency, "Flag Person Ahead" signs will be posted in advance of each flag person's station. Such signs will be removed promptly when the flagging operation terminates.
- 4.12 **Lighting**
- 4.12.1 Flagger stations should be illuminated. Lighting for workers on foot and equipment operators is to be at least 5 foot-candles or greater.
- 4.12.2 Where available lighting is not sufficient, flares or chemical lighting should be used.
- 4.12.3 Glare affecting workers and motorists should be controlled or eliminated.

4.13 Training

- 4.13.1 Flaggers should be trained/certified and will use the signaling methods required by the authority in charge.
- 4.13.2 WOF, equipment operators, and drivers in internal work zones need to know the routes that construction vehicles will use.
- 4.13.3 Equipment operators and signal persons need to know the hand signals used on the worksite.
- 4.13.4 Operators and WOF need to know the visibility limits and the "blind spots" for each vehicle on site.
- 4.13.5 WOF should wear high visibility safety garments designated as Class 1, 2 or 3.
- 4.13.6 Workers should be made aware of the ways in which shift work and night work may affect their performance.

4.14 Driving

- 4.14.1 Seatbelts and rollover protection will be used on equipment and vehicles as stated by the manufacturer.
- 4.14.2 When pulling off to the side of the road, Resolution Consultants personnel will park their vehicles at minimum of 20 feet or the width of two traffic lanes from moving traffic.

4.15 Night Operations and Work Within Traffic Controls

- 4.15.1 Night work on roadways should not be done unless absolutely necessary and unless the work area is adequately lit.
- 4.15.2 Operations with night activities will have a written plan that addresses the safety issues of working at night. The plan will address, but is not limited to:
 - Reflectivity
 - All equipment used in the work zone shall have DOT-approved reflective material placed to increase the visibility of the equipment.
 - All reflective surfaces shall be cleaned as required so that the reflectivity of the material is not degraded. Any areas of reflective surface that is damaged or obscured will be replaced.
 - Personnel working at night will have reflective tape on their hardhats and will wear retro-reflective vests at a minimum. The reflective bands on vests will be vertical and horizontal around the entire upper body.
 - Additional measures such as white disposable coveralls, reflective bands, and personal battery-operated strobe lights may be used when practical.
 - Illumination
 - Whenever feasible and practical, light plants will be used to illuminate the work area.
 - On mobile operations, additional lighting on equipment may be used to illuminate the work area.
 - All equipment shall, at a minimum, have working strobe or warning beacon lights.
 - All equipment shall have working lights confirmed through daily visuals.
 - All flag persons will be placed in illuminated areas only.
 - All lighting is to be checked after setup to confirm that it is not blinding approaching traffic or other equipment in the work zone.
 - Hazard Analysis and Communication
 - Prior to the start of any night operation, a detailed Hazard Analysis will be made addressing the possible hazards of night work. The Hazard Analysis will be reviewed with the crews and updated as needed. At the start of each shift, the Daily Safety Reminder will be used to reaffirm the provisions of the night work requirements as found in the hazard analysis and this policy.
 - The hazard analysis should also provide for:

- The selection of a competent person responsible for maintaining surveillance on the work area to alert other workers of vehicles encroaching on the work zone.
- A method to signal workers when vehicles encroach on the work zone.
- A system to account for workers at all times, which may include a buddy system.
- Emergency communication or warning signals used by a worker such as a radio, signal horn, or whistle, which will be used to call for help.

4.16 **Attenuator Vehicles**

4.16.1 Although not required, it is good construction practice to place an attenuator truck or pick-up truck (minimum) immediately ahead of workers in a work zone.

4.16.2 The vehicle of choice should be placed to provide the best protection for workers.

4.16.3 The tires should be placed so that when struck the vehicle will turn away from workers.

4.17 **Closures within a Closure**

4.17.1 On occasion, satellite operations may be performed under full freeway traffic closures. For this type of work, special precautions referred to as a "closure within a closure" is to be implemented in accordance with the following:

- Posted speed limits within closures should be set at 15 miles per hour.
- Signs are to be installed approximately 250 feet in advance of and behind the work zone to alert drivers who may approach from either direction of the upcoming work zone.
- The work area is to be completely delineated with Type 1 barricades (candlesticks).
- Any vehicle used for AECOM field work shall be equipped with a functioning rotating beacon placed on the roof of the vehicle.

5.0 **Records**

5.1 Traffic Protection Plans and completed Equipment Checklists will be maintained in project files.

6.0 **Attachments**

6.1 5-306 Form 1 Equipment Checklist

5-306-Form 1 Equipment Checklist

Name of Contractor:

Location:

Project #:

Date:

Time:

Weather:

Person Conducting Inspection:

Title:

*Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO**, this deficiency should be corrected as soon as possible.*

	YES	NO	OK	N/A
Are accident prevention signs, tags clearly visible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are danger signs used where immediate hazards exist?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are caution signs used to warn against potential hazards or to caution against unsafe practices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are exit signs posted at all exit locations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are proper visual warning signs posted prior to (in advance of) the work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers provided with signs, signals, and barricades to provide the necessary protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers using red lights when signaling during periods of darkness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers wearing highly visible warning garments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the flaggers trained in proper flagging procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are warning garments worn at night reflectorized?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are highly visible flags used by the flaggers at least 18 inches square?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are barricades used to totally obstruct the passage of people and vehicles to protect the work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do barricades meet the requirements set forth in the Manual of Uniform Traffic Control Devices? (MUTCD)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Deficiency Corrected?

COMMENTS:

5-307 Housekeeping, Worksite

1.0 Purpose and Scope

- 1.1 This procedure provides Resolution Consultants' work practices as well as personal hygiene and work site sanitation standards for housekeeping.
- 1.2 Applies to all Resolution Consultants staff and field worksites.

2.0 Terms and Definitions

None.

3.0 References

None.

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 **Project Manager (Field Task Manager, Supervisor)** is responsible for the procedure's implementation and the details of addressing housekeeping policy within the construction/demolition worksite.
- 4.1.2 **SH&E Professionals** will monitor, assess, and report on project housekeeping when visiting locations.
- 4.1.3 Employees are responsible for reporting any areas of concern to the Site Supervisor for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

4.2 Smoking, Eating, and Drinking

- 4.2.1 Eating and drinking will be permitted in designated areas at Resolution Consultant project sites and as specified on client sites. Smoking will be permitted only in areas designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Field Supervisor and situated in locations that are not in the immediate vicinity of activities associated with work site activities. Additionally, Field Supervisor will designate each smoking area giving primary consideration to those personnel who do not smoke.
- 4.2.2 Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).
- 4.2.3 Site personnel will first wash hands and face after completing work activities and prior to eating or drinking.

4.3 Water Supply

- 4.3.1 Water supplies will be available for use on site and will comply with the following requirements:
- 4.3.2 **Potable Water:** An adequate supply of drinking water will be available for site personnel consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified and tape sealed in order to distinguish them from nonpotable water sources and protect the potable water integrity.
- 4.3.3 **Nonpotable Water:** Nonpotable water will not be used for drinking purposes. Nonpotable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of nonpotable water used will be properly identified and labeled as such.

4.4 Toilet Facilities

- 4.4.1 Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities.

Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

4.4.2 A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on-site facilities are not required.

4.4.3 Washing Facilities

4.4.4 Hand and Face: Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

4.4.5 Personal Cleaning Supplies: Cleaning supplies at Resolution Consultant project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

4.5 **Clothing and Personal Protective Equipment (PPE)**

4.5.1 All PPE will be kept clean at all times and maintained in accordance with the manufacturer's, Resolution Consultant's, and applicable regulatory, legislative, or provincial requirements.

4.5.2 General Work Areas

4.5.3 At all times work areas will be kept free of dirt and debris that may impact the safety of site personnel and visitors. All trash receptacles will be emptied regularly.

4.5.4 Break Areas and Lunchrooms

Site personnel will observe the following requirements when using break areas and lunchrooms at Resolution Consultant project sites:

4.5.5 All food and drink items will be properly stored when not in use.

4.5.6 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.

4.5.7 Perishable foods will be refrigerated whenever possible.

4.5.8 All waste food containers will be discarded in trash receptacles.

4.5.9 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.

4.5.10 Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labeled as such so that only food and drinks are stored within the refrigerator.

4.5.11 Routine cleaning of refrigerators will also be performed on a regular basis.

4.6 **Vermin Control**

4.6.1 Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.

4.6.2 A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected.

4.7 **General Housekeeping**

4.7.1 All work areas shall be kept clean to the extent that the nature of the work allows.

4.7.2 Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footwear shall be provided.

4.7.3 Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.

- 4.7.4 Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.
- 4.7.5 At no time will debris or trash be intermingled with waste PPE or contaminated materials.
- 4.7.6 Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.
- 4.7.7 An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.
- 4.7.8 Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.
- 4.7.9 Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

4.8 Worksite Offices and Trailers

Worksite offices and trailers will be maintained in accordance with *RC-103-Housekeeping, Office*.

5.0 Records

None.

6.0 Attachments

None.

5-308-Manual Lifting, Field

1.0 Purpose and Scope

- 1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).
- 1.2 This procedure applies to all field staff for Resolution Consultants operations.

2.0 Terms and Definitions

- 2.1 **Manual Materials Handling:** Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.
- 2.2 **Team Handling:** Team handling occurs when more than one person is involved during the lift.

3.0 References

- 3.1 OSHA Technical Manual: http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html
- 3.3 National Safety Council: www.nsc.org

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 The **Project Manager** will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.
- 4.1.2 The **Resolution Consultants Health and Safety Manager** will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.
- 4.1.3 **Employees** are responsible for reviewing and following *5-308- Manual Lifting Safe Work Practices*.

4.2 Mechanical Controls

- 4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.
- 4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.
- 4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

4.3 Administrative Controls

- 4.4 When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.
- 4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

5.0 Records

None.

6.0 Attachments

None.

5-309 Mobile or Heavy Equipment

1.0 Purpose and Scope

- 1.1 Outline the safe working requirements for working with and near mobile equipment and heavy equipment operation.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 **Heavy equipment:** All excavating equipment include scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.
- 2.2 **Operator:** Any person who operates the controls while the heavy equipment in is motion or the engine is running.
- 2.3 **Ground personnel/workers:** Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

3.0 References

- 3.1 5-205 Equipment Inspections & Maintenance

4.0 Procedure

- 4.1 For work under Resolution Consultants' control, Project Managers are responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned.
- 4.2 Staff will confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.
- 4.3 The operator of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.
- 4.4 A person will not operate mobile equipment unless the person has received adequate instruction and training in the safe use of the equipment, has demonstrated to a qualified supervisor or instructor competency in operating the equipment.
- 4.5 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment
- 4.6 **Communication**
 - 4.6.1 Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.
 - 4.6.2 The following outline the communication requirements during heavy equipment operations:
 - Site supervisors/managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.
 - Site supervisors/managers shall inform all ground personnel before changes are made in the locations of designated work areas.
 - Prior to work initiating onsite the site supervisor/manager is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
 - Personnel working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.

- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (i.e., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.
- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a guide shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.7 **Ground Personnel**

4.7.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.7.2 The following outline the clearance requirements during heavy equipment operations:

- Ground personnel shall always yield to heavy equipment.
- Ground personnel shall maintain a suitable “buffer” area of clearance from all active heavy equipment.
- A job-specific hazard analysis that identifies any special precautions shall be completed and communicated to all Resolution Consultants personnel.
- Site supervisors/managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas. Designated areas shall include boundaries and travel routes for heavy equipment. Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
- When feasible, site supervisors/managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
- Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
- Operators shall only move equipment when aware of the location of all workers and when the travel path is clear.
- Ground personnel shall never stand between two pieces of heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.).
- Ground personnel shall never stand directly below heavy equipment located on higher ground.
- If working near heavy equipment, ground personnel shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
- Ground personnel shall never work near heavy equipment.
- Personnel shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- Personnel shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

4.7.3 At a minimum, all ground personnel and operators outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.).
- Retro-reflective striping for arms and legs (night work)
- ANSI-CSA approved hard hat
- ANSI-CSA approved safety glasses with side shields
- ANSI-CSA approved work boots (unless project requirements are more stringent)
- ANSI-CSA approved hearing protection as needed
- Appropriate work clothes (i.e., full length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

4.8 Prior to work commencing

- 4.8.1 All mobile equipment will be regularly inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.
- 4.8.2 The operator will report defects and conditions affecting the safe operation of the equipment to the supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.
- 4.8.3 Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers will be guarded and if a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.
- 4.8.4 An approved Underwriter's Laboratories (UL) 4A40BC fire extinguisher should be present on all mobile equipment.
- 4.8.5 Inform the operators of the equipment that Resolution Consultants employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, mobile equipment has the 'right of way'.
- 4.8.6 Where the operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.
- 4.8.7 Mobile equipment in which the operator cannot directly or by mirror or other effective device see immediately behind the machine will have an automatic audible warning device which activates whenever the equipment controls are positioned to move the equipment in reverse, and if practicable, is audible above the ambient noise level.

4.9 Operation

- 4.9.1 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.
- 4.9.2 A supervisor will not knowingly operate or permit a worker to operate mobile equipment which is, or could create, an undue hazard to the health or safety of any person.
- 4.9.3 The operator of mobile equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.
- 4.9.4 The operator will maintain the cab, floor and deck of mobile equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.
- 4.9.5 If mobile equipment has seat belts required by law or manufacturer's specifications, the operator and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.
- 4.9.6 When approaching or crossing the intended path of travel of mobile equipment, establish eye contact with the operator of the mobile equipment and confirm that it is safe to proceed.
- 4.9.7 Have vehicle headlights on at all times when driving in the area.
- 4.9.8 Park motor vehicles off the haul roads, or away from the work areas.
- 4.9.9 Do not wear loose clothing where there is a danger of entanglement in rotating equipment.
- 4.9.10 Do not enter the swing area of machines such as cranes, mobile drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so.
- 4.9.11 Stay out of the blind areas around mobile equipment and never assume that the equipment operators have seen them or are aware of their presence.
- 4.9.12 Maintain a distance of 60 cm (2 ft.) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.
- 4.9.13 Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.
- 4.9.14 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.

- 4.9.15 All heavy equipment shall be operated at safe speeds.
- 4.9.16 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.
- 4.9.17 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.
- 4.9.18 When feasible, operators shall travel with the "load trailing", if the load obstructs the forward view of the operator.
- 4.9.19 Slow down and sound horn when approaching a blind curve or intersection. Flagmen equipped with 2-way radio communications may be required to adequately control traffic.
- 4.9.20 Operators shall remain in cab while heavy equipment is being loaded.
- 4.9.21 Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.
- 4.9.22 Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended. Buckets and blades are to be placed on the ground and with hydraulic gears in neutral. Heavy equipment parked on slopes shall have the wheels chocked.
- 4.9.23 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.
- 4.9.24 Never exit heavy equipment while it is in motion.
- 4.9.25 Passengers shall only ride in heavy equipment designed for occupancy of passengers.
- 4.9.26 Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).
- 4.9.27 Site vehicles will be parked in a designated parking location away from heavy equipment.
- 4.9.28 Operators shall never push/pull "stuck" or "broken-down" equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.
- 4.9.29 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.
- 4.9.30 Equipment left unattended at night adjacent to traveled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (or the regulatory requirement for the work location) to the active roadway.
- 4.9.31 Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels.
- 4.9.32 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not exceeded.
- 4.9.33 Steering or spinner knobs shall not be attached to steering wheels.
- 4.9.34 High lift rider industrial trucks shall be equipped with overhead guards.
- 4.9.35 When ascending or descending grades in excess of 5%, loaded trucks shall be driven with the load upgrade.
- 4.9.36 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.
- 4.9.37 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.
- 4.9.38 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.
- 4.9.39 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

- 4.9.40 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.
- 4.10 **Utilities**
- 4.10.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.
- 4.10.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:
- Always be aware of surrounding utilities.
 - Confirm all equipment (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath of aboveground utilities.
 - If equipment must travel underneath overhead utility lines, a spotter shall be utilized to communicate with the equipment operator about equipment clearance, etc.
 - Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc.
- 4.11 **Training**
- 4.11.1 The operator or other qualified supervisor will provide all on-site personnel with an orientation to the mobile equipment and its associated hazards and controls.
- 4.11.2 Only designated, qualified personnel shall operate heavy equipment.
- 4.11.3 Operators shall have all appropriate local, state, or federal licenses or training to operate a designated piece of heavy equipment.
- 4.11.4 Operators shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by an Resolution Consultants operator in which case a practical evaluation is needed. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.
- 4.12 **Inspection and Maintenance**
- 4.12.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel during work hours.
- 4.12.2 Maintenance records will be maintained on the site or project for mobile equipment.
- 4.12.3 Servicing, maintenance and repair of mobile equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.
- 4.12.4 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use. Operators shall not operate heavy equipment that has not been cleared for use. All machinery and mechanized equipment will be certified to be in safe operating condition (certification form attached) by a competent individual seven days prior to on-site operation, and is valid for one year.
- 4.12.5 All heavy equipment shall be inspected at a minimum to the manufacturer's recommendations prior to each work shift. All defects shall be reported to the site supervisor/manager immediately. Inspection records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use the Heavy Equipment Pre-Operation Inspection Checklist (attached).
- 4.12.6 Defective heavy equipment shall be immediately taken out of service until repaired.
- 4.13 **Fueling and batteries**
- 4.13.1 Appropriate PPE shall be utilized when fueling or changing batteries (gloves, safety glasses, etc.)
- 4.13.2 A well-ventilated area shall be used for refueling.
- 4.13.3 Only the type and quality of fuel recommended by the engine manufacturer shall be used.
- 4.13.4 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.
- 4.13.5 No one shall spill fuel on hot surfaces. Any spillage should be cleaned before starting an engine.

- 4.13.6 Spilled fuel shall be cleaned with cotton rags or cloths; do not use wool or metallic cloth. If the spill results in ground impact, you shall immediately contact the Regional HSE professional for additional assistance.
- 4.13.7 Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.
- 4.13.8 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.
- 4.13.9 Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.
- 4.13.10 The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.
- 4.13.11 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.
- 4.13.12 Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge. If this is not possible then the use of a bonding strap shall be utilized to achieve bonding equilibrium.
- 4.13.13 Batteries shall be serviced in a ventilated area while wearing appropriate PPE.
- 4.13.14 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.
- 4.13.15 When installing a battery, the battery shall be connected ground post last.
- 4.13.16 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.
- 4.13.17 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.
- 4.13.18 Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water.
- 4.13.19 Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention sought immediately.
- 4.13.20 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around battery by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet away from battery-charging stations.

5.0 Records

- 5.1 Inspection records shall be maintained with the equipment.

6.0 Attachments

- 6.1 5-309 Form 1 Certification of Machinery and Mechanized Equipment
- 6.2 5-309 Form 2 Heavy Machinery Pre-Operation Checklist
- 6.3 5-309 Form 3 Brokk180 Safety Card

5-309 Form 1 Certification of Machinery and Mechanized Equipment

1.0 General Guidelines

- 1.1 Subcontractor equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 CFR 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front end loaders, backhoes, trackhoes, bulldozers, forklifts, and similar equipment used for the implementation of the project Statement of Work.

2.0 Equipment Safety Inspections

- 2.1 The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.
- 1.1.1 All machinery and mechanized equipment will be certified to be in safe operating condition (using the attached form) by a competent individual seven days prior to onsite operation. This certification is valid for one year.
- 1.1.2 Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.
- 1.1.3 Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.
- 1.1.4 Drill rigs and related support equipment and vehicles shall be inspected by the driller in charge on a daily basis. These inspections shall be recorded on the Daily Drill Rig Checklist or on equivalent subcontractor forms.
- 1.1.5 Exhaustive preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or the subcontractor's internal policies, schedules, and equipment SOPs.
- 1.1.6 Only designated qualified persons shall operate machinery and mechanized equipment.
- 1.1.7 The contractor shall maintain records of tests and inspections at the site and shall make the records available upon request of the designated authority; the records shall become part of the official project file.
- 1.1.8 Equipment found to not be in safe operating condition or to have a deficiency that affects the safe operation of the equipment shall immediately be taken out of service and its use shall be prohibited until safe conditions have been corrected.
- 1.1.9 All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.
- 1.1.10 Equipment with an obstructed rear view must have an audible alarm that sounds when equipment is moving in reverse.



TO: Resolution Consultants

DATE:

FROM:

Project Name:

Project Location:

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

Description of equipment work:	
Project site:	
Subcontractor providing equipment: Address:	
Dates (duration) of equipment work:	

2. Inspection and certification of machinery and mechanized equipment, as required by Resolution Consultants, has been made prior to but within seven calendar days in advance of use on the project site. Recertification will be required for equipment that is used on the project site for more than one year.

Identification of equipment (make, model, serial no.)		Date of Certification
1		
2		
3		

3. The above listed equipment has been inspected and tested as indicated above, and is **CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:**

Name		Title	
Company			
Signature		Date	

4. If there are any questions regarding this certification, please contact the following Resolution Consultants representative:



5-309 Form 2 Heavy Equipment Pre-Operation Checklist

Project Name/Location:															
Number/Name:									Make/Model:						
Hour meter reading:															
Check the following as appropriate	Operator Name/Date			Operator Name/Date			Operator Name/Date			Operator Name/Date			Operator Name/Date		
	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A
1. Operator qualified															
2. Overhead guard (ROPS)															
3. Horn															
4. Lights															
5. Parking brake															
6. Service brakes															
7. Steering															
8. Oil level															
9. Hydraulic oil level															
10. Radiator fluid level															
11. Major fluid leaks															
12. Windows															
13. Backup alarm															
14. Tires (visual)															



15. Seat belts															
16. Fuel leaks															
17. Fire extinguisher															
18. Fuel lines secure															
19. Electrical lines															
20. Exhaust components															

Comments/Remarks:

5-309 Form 3 Brokk180 Safety Card

1.0 Objective/Overview

The Brokk 180 is an electric-powered hydraulic device used for demolishing concrete structures and refractory linings as well as excavating. This machine includes attachments designed exclusively for demolishing work (e.g., grapple, bucket, hydraulic hammer, etc.). By using the remote control unit, an operator can move the machine and attachments in different directions and speeds from afar.



2.0 Safe Operating Guidelines

- 2.1 Prior to use, complete a pre-operation inspection to determine if the unit is in safe working condition.
- 2.2 Position the unit to safely perform the intended task, then deploy the outriggers to stabilize the unit.
- 2.3 Confirm that the operator knows what the lifting capacity is; do not exceed the lifting capacity.
- 2.4 Complete a subsurface utility clearance prior to excavating.
- 2.5 Establish a minimum 15-foot clearance around the unit.
- 2.6 Do not allow debris to build-up around the unit. Maintain good housekeeping practices.
- 2.7 Prior to removing debris from under the boom, stop, disengage the unit, and position the boom so that the attachment is at rest on the ground.
- 2.8 Personnel operating the unit with the remote control device will be properly trained and certified by a competent person.
- 2.9 The operator will be able to maintain line of sight visual contact with the unit at all times to assess hazards and site security.
- 2.10 Maintenance in excess of preventive maintenance activities (e.g., lubrication, replenishing fluids, etc.) will be performed by manufacturer personnel ONLY.
- 2.11 All operations will comply with the manufacturer's recommended policies.

3.0 Potential Hazards

- 3.1 Flying debris.
- 3.2 Crush/impact/pinch from extendable boom, tracks, and tipping over.
- 3.3 Electrocutation from subsurface utilities (when excavating).
- 3.4 Hearing loss.

4.0 Training Requirements

- 4.1 Review of applicable SOPs.
- 4.2 Complete knowledge and understanding of remote control functions.
- 4.3 Review and follow manufacturers' recommended policies and practices.

5.0 Personal Protective Equipment (Level D ensemble)

- 5.1 Reflective traffic safety vest.
- 5.2 Hearing protection (ear plugs and/or ear muffs).
- 5.3 Leather gloves.

6.0 Other Safety Tips

- 6.1 Never stand under a raised boom.
- 6.2 Maintain a clearance of 15 feet around the unit while operating.
- 6.3 Pay close attention to power cords for potential tripping hazard and equipment entanglement.
- 6.4 Maintain line of sight visual contact with unit at all times (especially when operating from a distance).

5-313 Wildlife, Plants and Insects

1.0 Purpose and Scope

- 1.1 Communicates the requirements and precautions to be taken by Resolution employees to protect against the biological hazards associated with insects, arachnids, snakes, poisonous plants, and other animals referred to herein collectively as “biological hazards”.
- 1.2 This procedure applies to all Resolution employees and operations.

2.0 Terms and Definitions

- 2.1 **Field Work:** Field work is defined as any activity conducted at a site that contains brush, overgrown grass, leaf litter, poisonous plants, or is located near mosquito breeding areas and includes work in structures where animals might exist that harbor fleas or ticks or where spiders and mites could be present. Field work includes, but is not limited to, Phase I, Phase II, Operations Monitoring & Maintenance (OM&M), biological surveys, and other work that meets the definition of field work.
- 2.2 **Poisonous:** Capable of harming or killing by or as if by poison; toxic or venomous.
- 2.3 **Phase I Environmental Site Assessment:** Investigation of real property to determine the possibility of contamination, based on visual observation and property history, but no physical testing. Under new Environmental Protection Agency regulations that went into effect on November 1, 2006, a Phase I, as it is called for short, will be mandatory for all investors who wish to take advantage of CERCLA defenses that will shield them from liability for future cleanup, should that prove necessary. The new Phase I rules, called “All Appropriate Inquiry” or AAI, also require more investigation than previously mandated. Investors can expect to see dramatic price increases over prior experiences.
- 2.4 **Phase II Environmental Site Assessment:** Investigation of real property through physical samplings and analyses to determine the nature and extent of contamination and, if indicated, a description of the recommended remediation method.

3.0 References

- 3.1 Public Health Agency of Canada (<http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php>) on Ticks and Lyme Disease in Canada
- 3.2 Public Health Agency of Canada (<http://www.phac-aspc.gc.ca/wn-no/index-eng.php>) on West Nile Virus
- 3.3 United States Center for Disease Control (CDC) (<http://www.cdc.gov/ncidod/dvbid/lyme/index.htm>) on Lyme Disease
- 3.4 New York State Department of Health, 2007. Health Advisory, Tick and Insect Repellents. <http://www.health.state.ny.us/nysdoh/westnile/pdf/2737.pdf>
- 3.5 Spectrum Brands, 2007. Personal Insect Repellent Products. http://www.spectrumbrandshomeandgarden.com/CorpNav/AboutSpectrum/ProductCategories/insect_repellent.htm
- 3.6 U.S. Centers for Disease Control and Prevention, 2004. Tick Management Handbook. <http://www.cdc.gov/ncidod/dvbid/lyme/resources/handbook.pdf>
- 3.7 U.S. Environmental Protection Agency, 2006. Permethrin Facts: Preregistration Eligibility Decision Fact Sheet. http://www.epa.gov/oppsrrd1/reregistration/REDs/factsheets/permethrin_fs.htm
- 3.8 U.S. National Pesticide Information Center, 1997, National Pesticide Telecommunications Network Fact Sheet for Permethrin. <http://npic.orst.edu/factsheets/permethrin.pdf>
- 3.9 U.S. Environmental Protection Agency, 2005. New Pesticide Fact Sheet, Picaridin <http://www.epa.gov/oppr001/factsheets/picaridin.pdf>

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Project Managers and Supervisors

- **Project Managers** and **Supervisors** responsible for managing field work will work with employees conducting the work to see that a Task Hazard Analysis (THA) for the work to be conducted has been performed prior to the beginning of the field work and that it includes an assessment of potential biological hazards.
- If biological hazards are identified as an exposure risk in the workplace, control measures that may be applied at the project site will be implemented to reduce the potential for employees to be exposed to injuries and illnesses while working.
- If the exposures cannot be eliminated or managed with engineering controls, the **Project Manager** or **Supervisor** will approve the use of PPE and protective repellents and lotions and ensure that exposed employees have and use these products.

4.1.2 District Operations Manager

- Approve the costs associated with the PPE and materials necessary to protect employees from the biological hazards covered by this Procedure.
- During the performance of project site visits, managers will assess the precautions being taken against the requirements of this Procedure.

4.1.3 Regional SH&E Manager

- Participate in incident reporting and investigations when appropriate.
- Work with office SH&E Department and project Safety Professionals, provide training and guidance to employees consistent with this procedure.
- Assist project teams in identifying hazards and selecting appropriate control measures.

4.1.4 Operational Managers

- Assure implementation of this procedure in their regions and offices.
- Participate in incident reporting and investigations when appropriate.

4.1.5 Employees

- Participate in required training on this procedure.
- Participate in the development of THAs for the project, identify control measures to limit exposure and request PPE, repellents, and protective lotions required by this Procedure.
- Obtain approval from **Project Managers** and/or **Supervisors** to purchase selected PPE prior to purchasing.
- Implement the precautions appropriate to prevent exposure to the hazardous wildlife, insects and plants.
- Observe requirements for reporting as detailed within the Procedure.
- Participate in incident reporting and investigations when appropriate.

4.2 Overview

4.2.1 The procedures discussed below are detailed because these hazards have historically posed the most significant risk to Resolution employees. Note that this discussion is not a fully encompassing list of hazards and as part of the Task Hazard Analysis conducted by the project team, additional consideration must be given to other biological hazards.

4.2.2 Departments of Public Health local to the worksite, as well as the Centers for Disease Control (CDC) can serve as a resource for identifying biological hazards not discussed in this Procedure.

4.2.3 If additional biological hazards are identified, the project team should contact the **Resolution SH&E Manager** to discuss the hazards and identify effective control measures that can be implemented at the project site.

4.3 **Planning and Hazard Assessment**

- 4.3.1 The Resolution project team shall ensure that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this SOP are integrated into the project planning process and conveyed to Resolution employees conducting the field work. This information shall be communicated in the site specific Safe Work Plan (SWP), Health and Safety Plan (HASP), the THA, pre-project kickoff meetings, and tailgate meetings at the project site.
- 4.3.2 It is important to note that the precautions to be taken by Resolution employees to decrease the risk of exposure to biological hazards can directly increase the risk of heat-related illness due to thermal stresses. Therefore, heat stress monitoring and precautions shall be included as a critical component of the project-specific hazard assessments in accordance with *5-511 Heat Stress Prevention*.
- 4.3.3 During the preparation of the project specific Safe Work Plan (SWP), HASP and project specific THA, **Project Managers, Supervisors**, and the project staff will determine what biological hazards might be encountered during the project and will prescribe the precautions to be taken to reduce the potential for exposure and the severity of resulting illnesses. Consideration will be given to conditions such as weather, proximity to breeding areas, host animals, and published information discussing the presence of the hazards.
- 4.3.4 It should be assumed that at least one of the biological hazards exists whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40°F for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.
- 4.3.5 The hazard assessments must also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with poison ivy, oak or sumac and hazards associated with the use of tools and equipment to remove vegetation.
- 4.3.6 Employees in the field where biological hazards exist will not enter the hazard areas unless they are wearing the appropriate protective clothing, repellents, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the THA, the affected employees shall stop work and not proceed until the THA has been amended and protective measures implemented.
- 4.3.7 A decision flow chart and table for determining the potential for biological hazards in US states has been provided in *5-313-Biological Hazard Assessment Decision Flow Chart Hazard Assessment (US States)*.

4.4 **Restrictions**

- 4.4.1 Staff with life-threatening reactions shall not undertake work in areas infested with the allergen (e.g., wasps, poison ivy), unless precautions are met which satisfy a medical practitioner's requirements.

4.5 **Employee Sensitivity**

- 4.5.1 Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin, therefore it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can be severe scarring, blindness or even death.
- 4.5.2 Employees also need to consider whether they are sensitive to the use of insect repellents.

4.6 **Personal Protective Equipment**

- 4.6.1 The selection of Personal Protective Equipment is dependent on the hazard present and a PPE Hazard Analysis should be conducted to determine situation specific PPE required. (refer to SOP 5-208 *Personal Protective Equipment Program*)
- 4.6.2 At a minimum, in addition to any project specific PPE, long sleeves and pants should be worn on field projects where the risk of biological encounter exists.
- 4.6.3 PPE for insects should include sunscreen, bug nets, bug jackets, or insect repellent. Socks should be pulled over pant legs and rubber boots should be worn where the threat of exposure is anticipated.

- 4.6.4 Epi-pens¹ or other personal medication should be carried by those staff that are aware that anaphylactic shock is a possibility for them.
- 4.7 **Remedies**
- 4.7.1 If you suspect exposure to an irritant, identify the cause including obtaining a specimen if possible. Document the occurrence as a safety precaution if the exposure should lead to complications.
- 4.7.2 Go to a doctor or call WorkCare for advice if necessary.
- 4.8 **Training**
- 4.8.1 Field staff must learn to recognize organisms that represent a threat in the regions in which they work – experienced field staff must provide on the job training to assist staff with hazard recognition.
- 4.8.2 Staff who have severe allergic reactions are strongly recommended to notify their project manager, field supervisor, and co-workers of the potential for a reaction and demonstrate what medication they might need and how it is administered.
- 4.9 **Insects**
- 4.9.1 Insects for which precautionary measures should be taken include but are not limited to: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, Fire Ants and European Fire Ants.
- 4.9.2 Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.
- 4.9.3 Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. The most serious concern is a possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. The larger Wood Ticks are widespread in the west but these rarely carry diseases. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.
- 4.9.4 The Fire Ant (southern and western US) and the European Fire Ant (northeastern US and eastern Canada) is often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.
- 4.10 **Ticks**
- 4.10.1 Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and therefore most related illnesses.
- 4.10.2 The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever. A summary table listing CDC informational resources for these diseases is provided in 5-313-Ticks, along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.
- 4.10.3 When working in areas where ticks may occur, it is recommended that clothes are turned inside out and shaken at the end of day; do not wear the same clothes two days in a row.
- 4.10.4 To remove ticks that are embedded in skin, use tweezers or fingers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick. Do not try to burn or smother the tick. Cleanse the bite area with soap and water, alcohol, or household antiseptic. Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister. A bit of moistened paper towel placed inside the container will keep ticks from drying out.

¹ Epi-pens must be prescribed by a personal physician. Renew epi-pens on a regular schedule to ensure effectiveness and make sure your field companions know where it is and how to use it if you cannot self administer the dose.

- 4.10.5 Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If noted, report to medical help for inoculation.
- 4.10.6 If possible, submit any ticks found or captured to the following laboratories for species identification.
- Canada – National Microbiology Laboratory (NML) (Phone: (204) 789-2000; email: ticks@phac-aspc.gc.ca). The NML will conduct diagnostic testing for the Lyme disease agent as well as several other disease-causing agents. The NML results will not only benefit anyone bit by the tick, but will also assist the NML in their goal to accurately map the distribution of the tick species and associated diseases in Canada.
 - US – IGeneX, Inc. (Phone: (800) 832-3200; www.igenex.com). IGeneX will test the tick for the presence of the Lyme bacteria. They also test ticks for *Babesia microti* and/or *Babesia duncani* (formerly WA-1), Ehrlichia, Bartonella henselae and Rickettsia (Rocky Mountain Spotted Fever). These diseases are also carried by ticks. The testing request form is attached as 5-313-FM Tick Test Request Form.
- 4.10.7 If you experience symptoms such as fever, headache, fatigue, and a skin rash, you should immediately visit a medical practitioner as Lyme disease is treated easily with antibiotics in the early stages, but can spread to the heart, joints, and nervous system if left untreated.
- 4.11 **Chiggers**
- 4.11.1 Chiggers are mite larvae, approximately ½ mm in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection.
- 4.11.2 Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze. They are active all year in the Gulf Coast and tropical areas.
- 4.12 **Spiders**
- 4.12.1 Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes.
- 4.12.2 Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the US and others outside the US inject a toxin that causes extensive tissue damage and intense pain.
- 4.12.3 Additional information on spider identification can be found in attachment 5-313-Poisonous Spider Identification.
- 4.13 **Mosquitoes**
- 4.13.1 Mosquitoes can transmit the West Nile Virus and other forms of encephalitis after becoming infected by feeding on the blood of birds which carry the virus. Positive cases of West Nile Virus have been confirmed throughout North America since 2007.
- 4.13.2 Most people infected with the virus experience no symptoms or they have flu-like symptoms. Sometimes though, the virus can cause severe illness, resulting in hospitalization and even death ,so proper precautions should be taken. Consult a medical practitioner if you suspect you have West Nile Virus.
- 4.13.3 When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.
- 4.13.4 CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk to employees working in outdoor environments. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:
- Eastern Equine encephalitis (EEE)
 - Western Equine encephalitis (WEE)
 - West Nile Virus
 - St. Louis encephalitis (SLE)
 - La Crosse (LAC) encephalitis

- 4.13.5 Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See 5-313-Mosquito Borne Diseases for information on the locations where mosquito borne diseases are known to be present.
- 4.14 **Bees and Hornets**
- 4.14.1 Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, and even on open ground. The flying/stinging insects are not specifically included in the scope of this procedure and the PPE and other protective measures are not normally effective against aggressive, flying insects. Avoid reaching into areas where visibility is limited.
- 4.14.2 If stung by a wasp or bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting, or any swelling or numbness beyond the site of the bite or sting.
- 4.14.3 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. Resolution highly recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.
- 4.15 **Poisonous Plants**
- 4.15.1 Poisonous plants including poison ivy, oak and sumac, which contain the oil urushiol that produces a rash, can lead to dermatitis and infections. Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the affected area, increasing susceptibility for an infection. It should be noted that each time an employee is exposed to urushiol the severity of the reaction increases. In cases that involve severe rashes, medical treatment may be necessary to control the rash.
- 4.15.2 Wild parsnip is found throughout the U.S. and contains a poison that produces a rash similar to poison oak and ivy. Unlike poison oak and ivy, the active oil will not be present on unbroken leaves..
- 4.15.3 Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed² (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock; Water Parsnip) – do not eat anything that has not been identified.
- 4.15.4 See 5-313-Plants of Concern for information on locations where some of these poisonous plants are found in the US.
- 4.15.5 Of the toxic plants in the cashew family, Poison Ivy (*Rhus radicans*) is most widespread occurring across southern Canada. It is usually a low sprawling shrub or ground cover but in southwestern Ontario it also grows as a thick woody vine that grows high into the tree canopy. Poison Oak (*Rhus diversiloba*) is a low shrub that grows only in southwestern British Columbia and Poison Sumac (*Rhus vernix*) is a tall shrub that grows in southern Ontario but is quite rare. All of these plants possess urushiol oils in nearly all parts of the plant. Touching the plant causes an itchy skin rash that shows up several days following contact. People have a wide range of reactions which in severe cases can lead to oozing blisters on large parts of the body. Some people apparently never react and others may develop an allergy after no reaction after years of frequent contact.
- 4.15.6 Several plants in the carrot family contain toxic sap that causes severe dermatitis if it comes into contact with skin that is then exposed to sunlight. The most serious reaction is caused by the Giant Hogweed (*Heracleum mantegazzianum*), a garden that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 5 m in height, which it does in one growing season. Contact causes painful blistering that can cause permanent disfigurement. It is to be avoided. Similar but less serious reactions can be caused by Meadow Parsnip (*Pastinaca sativa*) and Cow Parsnip (*Heracleum lanatum*). Meadow Parsnip can be very abundant on disturbed sites.
- 4.15.7 Nettles, particularly Stinging Nettle (*Urtica dioica*) and Wood Nettle (*Laportea canadensis*) contain urticating hairs on the leaves and stems that cause sharp pain or itchiness on contact with skin. The

² *Phytophthora* producer: keep skin covered and wash well after exposure
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irritation is immediate and normally lasts no more than an hour and there are no lasting consequences.

- 4.15.8 Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. Fragile Prickly Pear cactus (*Opuntia fragilis*) is common in semi arid areas of the southern Prairie Provinces and interior British Columbia. Pieces will break off and imbed into one's ankle by scarcely brushing them. Devils Club (*Oplopanax horridum*) can form dominant understorey in humid forests among the western mountains. It contains semi-soft spines on the stems that will break off in the skin causing considerable irritation for days. In some areas of Ontario, Prickly-ash (*Zanthoxylon americanum*) a tall shrub with sturdy spines, sometimes forms dense single stands that are nearly impenetrable.
- 4.15.9 A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants if you are not absolutely sure of their identity.
- 4.15.10 Of all the plants, Giant Hogweed presents the most serious health risk. Field staff should learn to recognize and avoid it if encountered.
- 4.15.11 Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will then forward the report to the **Regional SH&E Manager**.

4.16 **Additional Biological Hazards**

4.16.1 Additional Work Instructions are provided for protection and prevention from the following:

- 5-313-Snakes
- 5-313-Alligators

4.17 **Habitat Avoidance, Elimination, and/or Control**

4.17.1 Ticks, Spiders and Insects

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the project site of brush, high grass and foliage reduces the potential for exposure to biological hazards. Clearing will not eliminate the exposure to flying insects and there might be an increased exposure to ticks, spiders, and poisonous plants during the clearing process.
- Resolution projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the Resolution project manager shall either request that the client eliminate vegetation, or request approval from the client to have vegetation clearing added to the scope of work.
- When projects must be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures outlined in this SOP shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. Project Managers and client site managers should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water.
- If water cannot be drained, products similar to Mosquito Dunks® can be placed in the water to control mosquitoes. Once wet, the Mosquito Dunks® kill the immature, aquatic stage of the mosquito. The active ingredient is a beneficial organism that is lethal to mosquito larvae, but harmless to fish, humans, and other animals. Mosquito Dunks® provide long-term protection for 30 days or more.

4.17.2 Poisonous Plants

- If poisonous plants are identified in the work area, employees will mark the plants using either flags or marking paint, and discuss what the specific indicator will be to signal to other employees to avoid the designated area. If employees decide to use ground-marking paint to identify poisonous plants, they should discuss this tactic with the **Project Manager** and/or Client to gain approval.

- If removal of the plants is considered, it should be subcontracted to a professional landscaping service that is capable and experienced in removing the plant. If herbicides are considered for use, a discussion will need to occur with the **Project Manager** and Client to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.
- Resolution employees shall not attempt to physically remove poisonous plants from the work area unless a clearing procedure including PPE is prepared in advance and approved by the Regional SH&E Manager. If a SWP or HASP is prepared for the project, the clearing procedure should be included and the required PPE specified.

4.17.3 Bird Droppings

- Bird excrement may be encountered due to the nesting of pigeons and other birds and winged animals (e.g., bats) on or in structures. Substantial accumulations of droppings can pose physical and health risks as slippery surfaces (if wet) and if the material is disturbed and becomes airborne, it can be inhaled or ingested if personal hygiene practices are not implemented. Inhalation of airborne droppings can cause diseases such as histoplasmosis. Exposure to surfaces with bird droppings shall be safeguarded by implementing proper work practices, training employees for awareness and using PPE.

4.18 Personal Precautions and Personal Protective Measures

4.18.1 Precautions

- Be aware of the potential irritants in your area and know how to recognize them.
- Modify activities to avoid encounters (diurnal rhythms, seasonal rhythms).
- Wear protective clothing.
- When working in areas where there may be small insects that “hitchhike” (e.g., ticks, spiders, scorpions), it is recommended that clothes are turned inside out and shaken at the end of day; do not wear same clothes two days in a row.
- Staff should always be aware of where they are placing their hands, or where they are sitting in order to avoid contact with potential toxins.

4.18.2 PPE

- The following recommendations may be considered by the project team to determine if the use of PPE is necessary for the type of work planned: Disposable gloves may be cotton, leather, or synthetic materials and must not be reused after removing.
- Clearing activities present the greatest risk of employee exposure but reduce the risks once completed. Recommendation – Resolution employees actively participating in clearing will use full protection from ticks and insects during the clearing activities including insect repellents, Tyvek® coveralls, and gloves.
- If the foliage being cleared includes poisonous plants, exposed skin will be treated with a dermal barrier cream such as Tecnu®’s Oak ‘n Ivy Armor or Enviroderm’s Ivy Block and either a full face respirator or a half face respirator (with goggles) fitted with a P-100 (HEPA) dust filter.
- Work in habitats with direct exposure to ticks, mosquitoes, and poisonous plants is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from biological hazards including insect repellents, Tyvek® coveralls or full length clothing, poisonous plant barrier creams and wipes, and gloves.
- Work in habitats with direct exposure to ticks and mosquitoes and no exposure to poisonous plants is likely and the scope of work typically does allow for worksite control measures like vegetative clearing: Recommendation – Protection including insect repellents and Tyvek® coveralls or full length clothing.
- Work in habitats with direct exposure to poisonous plants and no exposure to ticks or insects is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from poisonous plants including insect repellents, Tyvek® coveralls or full length clothing, poisonous plant barrier creams and wipes, and gloves.
- Industrial/Commercial/Office Facilities – Direct contact with biological hazards is considered unlikely or low risk: Recommendation – PPE for biological hazards are not required; however, Tyvek coveralls and insect repellent should be available if exposure to spiders, flying insects, or other biological hazards is encountered.

- Work in areas where no biological hazards are expected because of the local environment, winter weather, or property development: Recommendation – PPE for biological hazards is not required; however, Tyvek® coveralls and insect repellent should be available if exposures to spiders, flying insects, or other biological hazards are encountered.
- The following precautions and protective measures shall be implemented by Resolution employees conducting field work where the biological hazards covered by this SOP exist:

4.18.3 Insects, Spiders, and Ticks

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Application of insect repellent to clothing and/or exposed skin.
- Routine personal checks.
- Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If stung by an insect or bitten by a spider or tick, attempt to identify the attacker and notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite, or any swelling or numbness beyond the site of the bite.
- Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the Centers for Disease Control and Prevention for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, employees can apply DEET to their skin and let dry prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.18.4 Poisonous Plants

- Employees working in areas where poisonous plants exist shall wear either long sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. Employees must not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants will be treated as contaminated, removed from the body in a manner that the contamination is not spread, and placed in plastic bags for disposal.
- Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu® or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol.
- Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu® cleanser.
- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.
- Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will forward the report to the RSHEM.
- For dermatitis caused by Poison Ivy, Poison Oak, or Poison Sumac, calamine lotion is effective.

4.19 Selection and Configuration of Field Clothing

4.19.1 At a minimum, employees will wear long legged pants and long sleeve shirts or Tyvek® coveralls to reduce the amount of exposed skin when biological hazards are identified at the work site. Gloves will also be worn consistent with the recommendations of the site-specific SWP, HASP and/or THA to minimize hand exposure.

4.19.2 Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically-treated clothing will be taped to the work boots.

4.19.3 See 5-313-Configuration Clothing for Protection against ticks and insects for illustrations and instructions for configuring, taping, and tucking clothing.

4.19.4 Chemical Treatment of Field Clothing

- Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the Centers for Disease Control and Prevention for effective protection against mosquitoes that may carry the West Nile virus and related diseases.

- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, employees can apply DEET to their skin prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.19.5 Permethrin

- When selected as part of a project's PPE requirements, the Resolution **Project Manager** shall ensure that field teams wear clothing treated with the chemical Permethrin, which is an insecticide with repellent properties registered with the U.S. Environmental Protection Agency (EPA), and recommended by the CDC. Information regarding the toxicity and product safety of Permethrin is provided in *5-313-Insect Repellent Active Ingredient Product Information*. Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during field work: 1) pre-treatment of fabric by the clothing manufacturer; or 2) employee treatment of their personal clothing using 0.5% Permethrin spray. Resolution strongly recommends the first option (employees obtaining pre-treated clothing) to avoid the time required, potential risk, and housekeeping issues involved with manually treating the clothing with spray. Purchase pre-treated clothing in accordance with *5-208 Personal Protective Equipment Program* and with the approval of your **Supervisor**.
- The Permethrin pre-treatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pre-treated clothing will be considered no longer effective and removed from service. Clothing that has been manually treated by employees will be considered effective for 5 wash cycles.
- Also, use of clothing that has been pre-treated with Permethrin offers a reduction in the use and application of other insect repellents that must be applied directly to the skin.. Costs for clothing shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as a department expense. **Supervisor** or **Department Manager** approval is required prior to purchase.
- If an employee opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they must either: 1) wear Tyvek® coveralls taped to the boots, 2) full length clothing consisting of long legged pants and long sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an organic alternative to their work clothing.

4.19.6 Manual Treatment of Field Clothing

- If clothing pre-treated with Permethrin is not available or not purchased prior to field work, employees may manually treat their clothing with Permethrin spray. The outer surfaces of all external clothing to be worn during field work should be treated with 0.5% Permethrin spray a minimum of 2 to 4 hours prior to field work (boots, trousers, shirt, jackets, rain gear; refer to Section 4.16 for selection of field clothing) in accordance with recommendations provided by the New York State Department of Health. This will likely require treatment at home or the office prior to field mobilization. Caution should be used when applying Permethrin as it is highly toxic to fish and house cats. Clothing treatment will last for approximately 5 wash cycles (check the specific instructions for the product used.)

4.19.7 Lemon Eucalyptus

- Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to six hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray has a pleasant scent and is not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied every two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.

4.19.8 Purchase of PPE and Repellents and Lotions

- Costs for clothing, repellents, lotions, and other PPE shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as a department expense. Supervisor or Department Manager approval is required prior to purchase.
- Material Safety Data Sheets (MSDS) for the repellents, lotions, and cleansers discussed in this Procedure are not required because the repellents, lotion, and clothing are consumer products used in the manner intended for the general public. Although not required, a MSDS should be

obtained for the products used and placed into the office MSDS library and site-specific health and safety plans.

4.20 **Personal Hygiene and Body Checks**

- 4.20.1 Tick-borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.
- 4.20.2 It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.
- 4.20.3 Employees will shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found, they should be removed using the technique described in *5-313-Ticks*, the tick should be preserved with the date and location of the bite noted, and retained for identification if medical treatment is needed as described in Section 4.13.1 of this Procedure.
- 4.20.4 The presence of an imbedded tick, rash, or abnormal reactions will be reported as an SH&E Incident to the **Project Manager** or **Supervisor** who will forward the report to the RCSHEM for follow up.

5.0 Records

None.

5-405 Drilling, Boring, and Direct Push Probing

1.0 Purpose and Scope

- 1.1 Provides the minimum requirements to be followed when drilling and boring work are performed.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

None.

3.0 References

None.

4.0 Procedure

- 4.1 All client on-site safety procedures shall be understood and adhered to.
- 4.2 Be aware of the provincial/territorial regulations that govern drill rig operations and exposed moving parts.
- 4.3 **Roles and Responsibilities**
 - 4.3.1 **Project Manager or Resident Engineer** is responsible for ensuring that sound principles of safety, training, inspection, maintenance, and operation consistent with all resource data available from the manufacturer, OSHA, and ANSI is provided to the operator and users by the Contractor or operating entity.
 - 4.3.2 **Site Safety Officer (SSO)** shall assist the **Project Manager** in compliance with the requirements of this procedure.
 - 4.3.3 The **H&S Department** shall assist site management with guidance about this procedure.
 - 4.3.4 **Resolution Consultants employees** engaged in project field activities shall be cognizant of contractor activities that may affect their safety and shall follow these procedures.
 - 4.3.5 **Resolution Consultants Equipment Operator**
 - In cases where Resolution Consultants owns and operates drilling, boring, or probing equipment, the lead equipment operator is responsible for the maintenance and safe operation of equipment under their control consistent with those responsibilities of a Contractor.
 - Operations will be terminated during an electrical storm, and all crew members will move away from the rig. If lightning is observed, shut down all rig operations immediately.
 - 4.3.6 **Contractors**
 - **Contractors** have direct control over the application and operation of all drilling, boring, and probing equipment owned by their organization.
 - It is the **Equipment Contractor** operator's responsibility to implement safe work practices provided by the **Contractor's** project management or supervisory staff supplemented by good judgment, safe control, and caution whenever operating drilling, boring, and probing equipment.
 - 4.3.7 **Safety Representative:** Unless the **Contractor** has a designated **Safety Representative**, the **Contractor's** responsible person for safety for the drill crew will be the drill rig operator. The safety person's responsibilities are to
 - Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
 - Be the leader in using proper personal protective equipment (PPE) and set an example in following the rules that are being enforced on others. See section 4.5 for PPE required by this SOP.



- Enforce the use of proper safety equipment and take appropriate corrective action when proper PPE is not being used.
- Understand that the proper maintenance of tools and equipment and general housekeeping on the drill rig will provide an environment that promotes and enforces safety. See Sections 4.7 and 4.9 for housekeeping and maintenance requirements of this SOP.
- Ensure that the operator has had adequate training and is thoroughly familiar with the rig, its controls, and its capabilities prior to commencement of drilling activities.
- Inspect the rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves.
- Check and test all safety devices such as emergency shutdown switches at least daily and preferably at the start of a work shift. Rig operation should not be permitted until all emergency shutdown and warning systems are working correctly. Wiring around, bypassing, or removing an emergency device is not permitted.
- Check that all gauges, warning lights, and control levers are functioning properly, and listen for unusual sounds on each starting of an engine.
- Ensure that all new rig workers are informed of safe operating practices on and around the rig. Provide each new rig worker with a copy of the organization's drilling operations safety procedures and, when appropriate, the rig manufacturer's operations and maintenance manual. The safety person should ensure that each new employee reads and understands the safety procedures.
- Ensure that a first aid kit and fire extinguishers are available and properly maintained on each rig and on each additional vehicle.
- Be well trained and capable of using a first aid kit, a fire extinguisher, and all other safety devices and equipment.
- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.), and inform other members of the drill crew of its location.
- See that new workers are instructed in rig safety, and observe the new worker's progress toward understanding safe operating practices.
- Observe the mental, emotional, and physical capability of workers to perform the assigned work in a proper and safe manner. Dismiss from the job site any worker whose mental and physical capabilities might cause injury to the worker or coworkers.
- Rig Crew and Other Field Personnel (Those employees involved in fieldwork): All personnel engaged in site activities are required to become thoroughly familiar with, and to conform to, the provisions of Resolution Consultants' safety plan, procedures, and such other safety directives as may be considered appropriate by **Project Managers, Safety Officers, and Supervisors**.
- Rig Workers: Personnel are encouraged to offer ideas, suggestions, or recommendations regarding any operational condition, procedure, or practice that may enhance the safety of site personnel or the public. Their primary responsibilities will be:
 - Perform all required work safely.
 - Familiarize themselves with and understand the plan, including proper use of personal protective equipment.
 - Report any unsafe conditions to supervisory personnel.
 - Be aware of signs and symptoms of thermal stress.

4.4 Training

- 4.4.1 All staff shall be provided with on-site orientation to the rig and its operator.
- 4.4.2 All operators and assistants shall have industry-standard safety training and be versed in the equipment to be utilized. This may include, but is not limited to, HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and others as appropriate.

4.5 Personal Protective Equipment

- 4.6 For most geotechnical, mineral, and/or groundwater drilling projects, PPE should include
- Hard hat: Hard hats shall be worn by everyone working at a drilling/boring site. Hats should meet the requirements of ANSI Z89 and be kept clean and in good repair with the headband and crown straps properly adjusted for the employee.
 - Safety shoes: Safety shoes or boots shall be worn by all drilling personnel and all visitors to the site who observe operations within close proximity of the rig. Safety shoes or boots should meet the requirements of ANSI Z4 1.1.
 - Safety glasses: All rig personnel shall wear safety glasses meeting the requirements of ANSI Z87.1.
 - High Visibility Class II Safety Vest shall be worn by all **Resolution Consultants employees**. All rig personnel should attempt to wear high-visibility clothing that should be close fitting and not have large cuffs or loose material that can catch on rotating or translating components of the rig.
 - Close fitting gloves and clothing: All rig personnel should wear gloves for hand protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. Gloves should be close fitting and not have large cuffs or loose ties which can catch on rotating or translating components of the rig.
 - Face shield: Face shields shall be worn by anyone performing battery maintenance activities where a splash hazard exists. Face shields shall meet the requirements of ANSI Z87.
 - Other protective equipment: For some operations, the project may dictate use of other protective equipment. The management of the contractor and its safety person shall determine the requirements. Such equipment might include face or ear protection or reflective clothing. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client.
 - Each worker should wear noise reducing ear protectors around operating equipment or during elevated noise levels.
 - When drilling, boring, or probing is performed in chemically or radiological contaminated ground, special protective equipment and clothing will probably be required.
 - The clothing of the individual rig worker is not generally considered protective equipment; however, clothing should be close fitting and comfortable without loose ends, straps, draw strings or belts or otherwise unfastened parts that might catch on some rotating or translating component of the rig. Rings and jewelry should not be worn during a work shift.

4.7 Housekeeping

- 4.7.1 A key requirement for safe field operations is that the Contractor safety person understands and fulfills the responsibility for maintenance and “housekeeping” on and around the drill rig, including the following:
- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the crew or a visitor.
 - Storage or transporting tools, materials, or supplies within or on the mast (derrick) of the rig should be avoided.
 - Pipe, drill rods, probe rods, casing augers, and similar tooling should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.
 - Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.

- Work areas, platforms, walkways, scaffolding and other accesses should be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- All controls, control linkages, warning and operation lights, and lenses should be kept free of oil, grease, and/or ice.
- Do not store gasoline in any portable container other than a non-sparking, red safety container with a flame arrester in the fill spout and having the word “gasoline” easily visible.

4.8 **Traffic Control**

4.8.1 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passerby pedestrians.

4.8.2 All traffic control devices shall be installed, placed, and maintained in accordance with the Traffic Control Plan, client specifications, and/or the Manual of Uniform Traffic Control Devices (MUTCD). Traffic control devices shall consist of and not be limited to:

- Directional and informational signage;
- High visibility barricades, cones, or barrels;
- Lighting; and
- Other equipment and devices as required.

4.9 **Maintenance & Inspection**

4.9.1 Good maintenance and thorough inspection will make operations safer. Maintenance tasks should be done safely by a qualified maintenance person. Inspection and maintenance tasks include but are not limited to the following requirements:

- Inspections shall be completed at the beginning of each day by the equipment operator and in the presence of an Resolution Consultants employee when the equipment is not owned and operated by Resolution Consultants.
- Safety glasses should be worn when performing maintenance on a rig or on drilling or probing tools.
- The drill rig engine should be shut down to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running).
- Precautions should be taken to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.
- Wheels or the lowering of leveling jacks or both should be blocked (“zero energy state”) and hand brakes set before working under a drill rig.
- When possible and appropriate, all pressure on the hydraulic systems should be released as well as the drilling fluid system and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating systems to a “zero energy state” before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Personnel shall not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have adequate time to cool.
- Welding and cutting shall not occur on or near a fuel tank.
- Wire rope safety factors shall be in accordance with American National Standards Institute B 30.5-1968 or SAE J959-1966.
- Gasoline or other volatile or flammable liquids shall not be used as a cleaning agent on or around a rig.
- The manufacturer's recommendations should be followed for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.
- All caps, filler plugs, protective guards, panels, high-pressure hose clamps, chains, or cables that have been removed for maintenance should be replaced.

4.10 **Hand Tools**

4.10.1 A large number of hand tools can be used on or around a drill or probe rig and in repair shops and more than an equal number of instructions for proper use exist. "Use the tool for its intended purpose" is the most important rule. Additionally, equipment operators and assistants should not use their hand in place of the proper tool; work shall be stopped until the correct tool can be found. The following are a few specific and some general suggestions that apply to the safe use of several hand tools that are often used on and around rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and orderly stored when not in use.
- Use wrenches on nuts; don't use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing – check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease which would otherwise build up and cause wrenches to slip. Replace hook and heel jaws when they become visibly worn.
- Avoid the use pipe wrenches in place of a rod-holding device whenever possible.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

4.11 **Clearing Work Areas**

4.11.1 Prior to set up, adequate site clearing and leveling should be performed to accommodate the rig and supplies and provide a safe working area. Clearing the site includes clearing the intended drilling area of underground utilities in accordance with *5-417-Utilities Underground*. Drilling or probing should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

4.11.2 **Start-Up**

- All rig personnel and visitors should be instructed to "stand clear" of the rig immediately prior to and during starting of an engine.
- Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the neutral-actuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

4.12 **Drilling and Probing Operations**

4.12.1 The following safety measures shall be taken during drilling and probing operations on-site:

- The operator and helper shall be present during all active rig operations.
- Site personnel shall remain within visual contact of the rig operator.
- Hard hats, approved safety boots and hearing protection shall be worn in the presence of a rig.
- Services shall be cleared prior to drilling or probing.
- Hands shall be kept away from moving parts (augers).
- The emergency shut-off switch on the rig should be identified to site personnel and tested on a regular basis by the operator.

- Unauthorized personnel shall be kept clear of the rig.
- 4.12.2 Safety requires the attention and cooperation of every worker and site visitor.
- Do not drive the rig from hole to hole with the mast (derrick) in the raised position.
 - Before raising the mast (derrick) look up to check for overhead obstructions. Refer to 5-417-*Utilities, Underground* and 5-406-*Electrical Lines, Overhead*.
 - Before raising the mast (derrick), all rig personnel (with the exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All rig personnel and visitors should be informed that the mast is being raised prior to raising it.
 - Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig shall be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
 - Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
 - The operator of a rig should only operate a drill rig from the position of the controls. If the operator of the rig shall leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.
 - Throwing or dropping tools will not be permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.
 - Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a rig or while on the job.
 - If it is necessary to operate the rig within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic and some cannot be detected by smell.
 - Clean mud and grease from your boots before mounting a rig platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.
 - During freezing weather, do not touch any metal parts of the rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
 - All air and water lines and pumps should be drained when not in use if freezing weather is expected.
 - All unattended bore holes shall be adequately covered or otherwise protected to prevent rig personnel, site visitors, or animals from stepping or falling into the hole. All open bore holes should be covered, protected, or backfilled adequately and according to local or state regulations on completion of the drilling project.
 - "Horsing around" within the vicinity of the drill rig and tool and supply storage areas should never be allowed, even when the rig is shut down.
 - When using a ladder on a rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Always use adequate fall protection and a full body harness when climbing above six feet of the ground. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

4.13 **Elevated Derrick Platforms**

4.13.1 The following precautions should be used:

- When a rig worker first arrives at a derrick platform, the platform should immediately be inspected for broken members, loose connections, and loose tools or other loose materials.
- A derrick platform over 4 feet (1.2 m) above ground surface should have toe boards and safety railings that are in good condition.
- When climbing to a derrick platform that is higher than 6 feet (2 m), a fall arresting device shall be used. The fall arresting device should consist of a full body harness and fall protection. The harness should fit snugly but comfortably. The lifeline when attached to the derrick should be less than 6 feet (2 m) long and attached to a fall arrester. The harness and lifeline should be strong enough to withstand the dynamic force of a 250-pound (115 kg) weight (contained within the belt) falling 6 feet (2 m).

- When a rig worker is on a derrick platform, the lifeline should be fastened to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools should be securely attached to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.
- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Loose tools and similar items should not be left on the derrick platform or on structural members of the derrick.
- Workers on the ground or the drilling floor should avoid being under rig workers on elevated platforms whenever possible.

4.14 **Lifting Heavy Objects**

- 4.14.1 Before lifting any object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.
- 4.14.2 Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.
- 4.14.3 If a heavy object shall be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.
- 4.14.4 Move heavy objects with the aid of handcarts or lifting devices whenever possible.

4.15 **Use of Wire Line Hoists, Wire Rope, and Hoisting Hardware**

- 4.15.1 The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron Steel Institute, Wire Rope Users Manual.
- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes that have not been used for a period of a month or more should be thoroughly inspected before being returned to service.
 - End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.
 - If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.
 - If a rod-slipping device is used to hoist drill or probe rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 foot (. 3 m) of the rod column above the top of the mast (derrick); and do not hoist a rod column with loose tool joints while the rod column is being supported by a rod slipping device. If rods should slip back into the hole, do not attempt to break the fall of the rods with your hands or by applying tension to the slipping device.
 - Most sheaves on exploration drill rigs are stationary with a single part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig.
 - Wire ropes shall be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope; if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes and therefore shall be replaced.
- 4.15.2 The following procedures and precautions shall be understood and implemented for safe use of wire ropes and rigging hardware.
- Use tool-handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool-handling hoists to pull on objects always from the rig; however, drills may be moved

using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

- When struck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope. Apply loads smoothly and steadily. Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Clutches and brakes of hoists should be periodically inspected and tested.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up and when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel. Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

4.16 **Use of Cathead and Rope Hoists**

4.16.1 The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 inches (3 mm), the cathead should be replaced.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.
- The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.

- Never operate a cathead (or perform any other task around a drill rig) with loose unbuttoned or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacinings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum. Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator shall be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

4.17 **Use of Augers**

4.17.1 The following general procedures should be used when starting a boring with continuous flight of hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.
- The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnection auger sections, and inserting and removing the auger fork. The operator shall ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

4.18 **Rotary and Core Drilling**

4.18.1 Rotary drilling tools should be safety checked prior to drilling:

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight to the drill rod string plus other expected hoisting loads.

- 4.18.2 Special precautions that should be taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods:
- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
 - Drill rods should not be braked during lowering into the hole with drill rod chuck jaws. Drill rods should not be held or lowered into the hole with pipe wrenches.
 - If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
 - In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
 - When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
 - If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
 - Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

4.19 **Site Movement of Equipment**

4.19.1 The individual who transports a rig on and off a drilling site should:

- Be properly licensed and should only operate the vehicle according to federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length and weight of the rig with carrier and know highway and bridge load, width and overhead limits, making sure these limits are not exceeded with an adequate margin.
- Never move an I rig unless the vehicle brakes are in sound working order.
- Allow for mast overhand when cornering or approaching other vehicles or structures.
- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the rig in the raised or partially raised position.
- Remove all ignition keys if rig is left unattended.

4.19.2 Loading and Unloading

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the rig with carrier, including tools.
- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the rig carrier before approaching loading ramps.
- Distribute the weight of the rig, carrier, and tools on the trailer so that the center of eight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the high of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.
- The rig and tools should be secured to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

4.19.3 Off-Road Movement

The following safety suggestions relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the drill has been moved to a new drilling site, set all brakes and/or locks. Always block/chock the wheels.

4.20 **Tires, Batteries, and Fuel**

- 4.20.1 Tires on the rig shall be checked daily for safety and during extended travel for loss of air and they shall be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be inflated to normal pressures before movement on firm or hilly ground or on streets, roads and highways. Under-inflated tires are not as stable on firm ground as properly inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:
- Missing or loose wheel lugs.
 - Objects wedged between dual or embedded in the tire casing. Damaged or poorly fitting rims or rim flanges.
 - Abnormal wear, cuts, breaks, or tears in the casing.
 - The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacturer's repair manual.
- 4.20.2 Batteries contain strong acid. Use extreme caution when servicing batteries.
- Batteries should only be serviced in a ventilated area while wearing safety glasses (and face shield if a splash hazard exists).
 - When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
 - When installing a battery, connect the battery ground clamp last.
 - When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
 - Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid should be immediately flushed off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a physician at once.
 - To avoid battery explosions, keep the cells filled with electrolyte; use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.
- 4.20.3 Special precautions shall be taken for handling fuel and refueling the rig or carrier. Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.



- Do not fill fuel tanks while the engine is running. Turn off all electrical switches. Do not spill fuel on hot surfaces. Clean any spillage before starting an engine. Wipe up spilled fuel with cotton rags or cloths. Do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Fuel containers and hoses should remain in contact with a metal surface during travel to prevent the buildup of static charge.

4.21 **First Aid**

4.21.1 At least one member of the crew (and if only one, preferably the drilling and safety supervisor) should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red Cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

4.21.2 For drilling and probing operations it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crewmembers by instructors qualified by an agency such as the American Red Cross.

4.21.3 A first aid kit should be available and well maintained on each drill site. The contents of the first aid kit shall be placed in a weatherproof container with individual sealed packages for each type of item.

4.22 **Rig Utilization**

4.22.1 Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc.

4.22.2 Only use the drill rig and tools for the purposes that they are intended and designed.

4.23 **Rig Alterations**

4.23.1 Alterations to a rig or drilling or probing tools should only be made by qualified personnel and only after consultation with the manufacturer.

5.0 **Records**

None.

6.0 **Attachments**

None.

5-406 Electrical Lines, Overhead

1.0 Purpose and Scope

- 1.1 Provides the safe work requirements to be observed where overhead power lines are present on a job site.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 Types of overhead lines:
 - 2.1.1 Overhead power lines
 - 2.1.2 Structural cable supports
 - 2.1.3 Guy wires
 - 2.1.4 Cable television / communication lines

3.0 References

None.

4.0 Procedure

- 4.1 An appropriate distance must be kept between equipment and overhead utility lines.
- 4.2 Employees must contact the power line operator before work is done or before equipment is operated within 15.25 metres (50 feet) of an energized overhead power line, in order to:
 - determine the voltage of the power line, and
 - establish the appropriate safe limit of approach distance as identified by provincial/territorial regulations.
- 4.3 The safe limit of approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 4.15 metres (13.5 feet).
- 4.4 **Employers or CTO Managers** must formally notify (using the Overhead Electrical Lines Acknowledgement form) all subcontractors or equipment operators of an energized overhead power line before work is done or equipment is operated in the vicinity of the power line at distances less than the safe limit of approach distances and obtain the operator's assistance in protecting workers involved.
- 4.5 Employees must not place earth or other material under or beside an overhead power line if doing so reduces the safe clearance to less than the safe limit of approach distances.
- 4.6 To maintain minimum safe clearances:
 - 4.6.1 Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).
 - 4.6.2 Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.
 - 4.6.3 Position signs or other devices to determine the "Danger Zone."
 - 4.6.4 Inform all on-site staff with the on-site clearances required.
 - 4.6.5 Beware of atmospheric conditions, such as temperature, humidity, and wind, that may dictate more stringent safety procedures.
- 4.7 Operation of heavy equipment and cranes in areas with overhead power lines represents a significant hazard to all personnel on the job site. Accidental contact with an energized line or arcing between a

high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment. Although maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this. If work will (or may) occur within 50 feet of any energized line, the procedures outlined below will be observed.

- 4.8 Overhead power lines will be identified on each job site before the work commences. For each identified line, the Project Manager must determine whether it is energized (and the operating voltage for energized lines), and whether work operations will require that activities with heavy equipment (excavators, loaders, cranes, etc.) will occur within 50 feet (15.25 metres) of the line. Unless verified, it will be assumed that all lines are energized.
- 4.9 Safe working distance is the minimum distance that must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins and is based on the line voltage of the power line. Figure 4-1 lists the line voltages in kilovolts and the Minimum Safe Work Distance in the United States and Figure 4-2 indicates the Nominal Phase to Phase voltage rating in kilovolts for Canada. The following safe working distance criteria will be applied for all Resolution Consultants operations:

Figure 4-1: United States Overhead Line Criteria

Line Voltage (Kilovolts)	Minimum Safe Working Distance
0 – 50	10 feet
>50 – 200	15 feet
>200 – 350	20 feet
>350 – 500	25 feet
>500 – 750	35 feet
>750 – 1,000	45 feet

Source: American National Standards Institute, Publication B30.5.

Figure 4-2: Canadian Overhead Line Criteria

Column 1	Column 2
Nominal phase-to-phase voltage rating	Minimum Distance
Over 425 to 12,000	3.0 metres
Over 12,000 to 22,000	3.0 metres
Over 22,000 to 50,000	3.0 metres
Over 50,000 to 90,000	4.5 metres
Over 90,000 to 120,000	4.5 metres
Over 120,000 to 150,000	6.0 metres
Over 150,000 to 250,000	6.0 metres
Over 250,000 to 300,000	7.5 metres
Over 300,000 to 350,000	7.5 metres
Over 350,000 to 400,000	9.0 metres

Source: Canada Occupational Health and Safety Regulations Electrical Safety- Subsection 8.5(6).

4.10 Under no circumstances will any object pass closer than 3 metres to any energised, uninsulated electrical line.

4.11 Formally notify all subcontractors of Overhead Power lines.

4.12 **Acceptable Safety Procedures**

4.12.1 Where any work task will not allow the minimum safe working distance to be maintained at all times, an alternate means of protection must be identified and approved by the SH&E Department. In order of preference, acceptable procedures are

- De-energize the power line(s)/lockout by local utility authorities
- Install insulated sleeves on power lines
- Assign line spotters to assist the equipment operator

4.12.2 De-energize Power Lines

Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site power lines are under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the owner of the line (generally the local electrical utility). Therefore, de-energizing of a line requires advance coordination with the line owner; generally, at least one week advance notice should be provided.

4.12.3 Install Insulating Sleeves

Insulating sleeves can be placed over power lines to provide a contact and arcing barrier if work must occur closer to the power lines than the accepted safe work distance. Although not as desirable as line de-energizing, the use of these sleeves can provide an acceptable alternative where electrical lines are required to remain in service.

As with de-energizing of distribution and transmission lines, placement of insulating sleeves can be performed only by the line owner. This requires advance coordination with the line owner; generally, at least one week advance notice should be provided. To install the sleeves, representatives of the line owner will require access to the job site.

4.12.4 Assign Line Spotters

A line spotter is a person located at ground level who is assigned to observe equipment operations, with the specific duty of assisting the equipment operator to ensure that no part of the equipment gets too close to an energized, unprotected electrical line.

Persons assigned to act as line spotters must meet the following requirements:

- While acting as a line spotter, no other duties may be performed (e.g., the line spotter cannot also act as the load spotter during a lifting operations).
- The spotter will have a radio or other direct means of communicating with the equipment operator at all times.
- The spotter will be positioned at a right angle to the equipment operator's line of sight to maximize the sight angles between the personnel.

Under no circumstances will any portion of a piece of equipment pass closer than 10 feet to any energized, uninsulated electrical line.

4.13 **Additional Safety Measures**

4.13.1 The following additional safety measures can be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures in Section 4.1.

4.13.2 If an electrical power line is hit or an electrical arc occurs:

- All ground personnel must evacuate IMMEDIATELY to a distance of at least 50 feet (15.25 metres). DO NOT attempt to rescue any injured person until the line can be de-energized.
- The operator should remain in the cab until the line can be de-energized and should carefully try to extricate the equipment from the power line. This may not be possible where melting of insulator material or metal has occurred.
- Contact the line owner to report the line contact and request that the line be de-energized immediately.
- Once the line has been confirmed to be de-energized, the operator can safely evacuate the cab and rescue can commence for any injured personnel.
- Contact the SH&E Department to report the incident and implement any instructions provided.

If the operator must evacuate while the line is still energized (because of fire or other life-threatening condition) he/she should jump clear of the equipment (making sure to avoid touching the equipment and the ground simultaneously), and land upright and with feet together. Once on the ground, proceed in a direct line away from the equipment using a short, shuffling gait (feet touching, sliding each foot no more than 1 foot forward at a time) to minimize shock hazard from electrical energy being transmitted through the ground.

5.0 Records

None.

6.0 Attachments

None.

5-417-Utilities, Underground

1.0 Purpose and Scope

- 1.1 Establishes requirements to ensure that underground installations are identified properly before excavation work commences.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 **Underground Utilities:** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.
- 2.2 **Ground Disturbance (GD):** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.

3.0 References

- 3.1 American Public Works Association, Excavator's Damage Prevention Guide and One-Call System Directory International 1990-1991, Utility Location and Coordination Committee.

4.0 Procedure

- 4.1 Ground disturbance may be conducted for a variety of purposes, including, but not limited to, exposing existing buried lines, soil sampling, remedial excavations, or installing monitoring wells or test pits.
- 4.2 Improper ground disturbance may impact a buried pipeline or utility line and cause a major release of a hazardous substance, flood, or electrocution. Serious injuries and significant property damage have resulted from insufficient/inadequate identification of underground installations during the course of ground disturbance work.
- 4.3 To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted.
- 4.4 **CTO Managers** are responsible for ensuring that all work, including the identification, location, and access to all underground utilities, is planned and performed in accordance with contract specifications and safety requirements.
 - 4.4.1 The planning for associated work and avoidance of contacting underground utilities shall be part of the project safety planning in the HASP.
- 4.5 The **CTO Manager or Site Supervisor** is responsible for the execution of work in accordance with this and other associated Resolution Consultants SOPs, including:
 - The review of the HASP.
 - Verification that all steps have been taken to identify existing underground utilities in the area to be disturbed.
- 4.6 **Regional SH&E Professional** provides guidance as needed.
- 4.7 **Personal Protective Equipment**
 - Long sleeved shirt and pants (coveralls/Nomex LILA for upstream oil and gas)
 - Safety toe boots
 - Hard hat
 - High-visibility clothing
 - Gloves

- Respirator with organic vapor/particulate filter cartridge (for use when the exposure exceeds the occupational exposure limit stated on the MSDS), as required
- Hydrogen Sulfide (H₂S) Monitor (for areas with known or suspected H₂S)

4.8 **Training**

- 4.8.1 Staff shall successfully complete a Ground Disturbance training course.
- 4.8.2 Some clients may also have required client-based Ground Disturbance training.

4.9 **Underground Utility Lines**

- 4.9.1 To avoid injury from electrical and other utilities on site, utility lines shall be located and marked prior to conducting any drilling or digging on site. If available, refer to site drawings or client interviews for information pertaining to utilities on site.
- 4.9.2 Types of underground lines:
- Gas line
 - Potable water line
 - Raw water line
 - Sewer line
 - Power line
 - Cable television/communication line
 - Cathodic protection lines
 - Grounding cable
 - Process piping/flow line
- 4.9.3 Prior to conducting the ground disturbance, you shall locate all pipelines and utilities that pass within (30 m) of the work area. This is your search and control area. To do so, you need to do the following:
- Notify all pipeline and utility companies, and confirm that their notification requirements are fulfilled prior to conducting a ground disturbance.
 - Identify pipelines, power lines, utilities, and irrigation canals in a 30-foot (9.1 m) zone of the work area with the owner of the utility.
 - On private property, a properly trained and competent third party utility locator shall be used.
 - Get approval for work within a right-of-way (ROW) or within 15 feet (4.6 m) of a line if there is no ROW.
 - Prepare a site map identifying the search area, the ground disturbance area, and known underground utilities.
 - Confirm that all pipelines, power lines, and utilities are marked.
- 4.9.4 Look for pipeline indicators:
- Look for warning signs where pipelines cross roads or water courses.
 - Look for cut lines, wells, tanks, or valves that may indicate the presence of pipelines.
 - Look for ground settling from previous work.
 - Talk to nearby landowners and residents.
 - Look for vegetation appearing “different” from the surrounding vegetation (e.g., greener, taller, shorter, or more brown than surrounding vegetation).

- 4.9.5 When you are working within a pipeline right-of-way, you shall get written approval from the pipeline owner prior to doing your work.
- 4.9.6 Call the pipeline owner at least two full working days before you dig so the pipeline can be located and marked.
- 4.9.7 Expose the pipeline by hand/hydrovac before digging within 15 feet (4.6 m) of the pipeline with machinery (no machinery comes may come within 2 feet [60 cm] of the pipeline) with the supervision of the owner or their representative, and call the owner at least one full day before you cover the exposed line.
- 4.9.8 During ground disturbance:
- All underground utilities shall be hand exposed or hydrovac'd within 3.3 feet (1 m) of a mark out or within the distance required by the owner of the utility before operating any mechanized equipment.
 - Make arrangements for supervision ("a Signal Person") during hand exposure.
 - If for any reason these hand excavations are temporarily filled in, mark them.
 - Make arrangements for supervision ("a Signal Person") during any mechanical excavation within 5 m of the underground utility.
 - Make arrangements for supervision ("a Signal Person") during backfilling of utilities.
 - Cutting back and shoring of excavations shall be completed to ensure that there are no cave-ins (follow *5-303-Excavation and Trenching*).
 - Do not damage utilities by shovels when hand exposing and picks should not be used.
 - Remember that all workers have the right and responsibility to refuse to carry out any work or procedures that they feel are unsafe.
 - If the ground disturbance is deeper than 3.3 feet (1 m), all crew members shall have appropriate training for excavations and trenches and shall be protected from cave-ins or sliding/rolling materials (follow *5-303-Excavation and Trenching*).
 - Remember that incidents, injuries, and near misses shall be reported immediately.
 - Review the site-specific emergency response plan.
- 4.9.9 If you hit an underground facility, stop the work immediately and notify the owner of the facility.
- The owner shall be informed of the location of the contact and the type of damage that resulted.
 - If the facility is a pipeline, the company (client) shall immediately notify the required agencies and regulatory bodies of the location of the contact and the type of damage that resulted.
 - The government agencies will require a written record and the company (client) should conduct an incident investigation into the causes and make recommendations for the future prevention of this incident.
- 4.10 **Identification of Installations**
- 4.10.1 Various forms of underground utility lines or pipes may be encountered during Resolution Consultants deployments to field sites. Damaged utilities, in particular, can present other hazards including asbestos, explosion, electric shock, scalding, etc., and they shall be avoided. The presence of damaged utilities at any work location shall be immediately brought to the attention of the site supervisor or other member of the Resolution Consultants site management team.
- 4.10.2 Guidance will be provided on the appropriate action to be taken, which could include suspension of work until the responsible utility agency is contacted and the hazard is either isolated or eliminated.
- 4.10.3 Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not consistent as shown on drawings, as indicated by the placement of surface signage, or as described by personnel. Coordination and planning of the job shall be required with the client or owner.
- Prior to digging and drilling operations, the client shall always be informed of the potential location(s) of underground utility systems.
 - If a utility permit is required from the client or owner, it shall be secured.
 - The client shall explain how the utility line may be identified—e.g., red concrete encasement.

- All underground installations shall be considered “live” and “operational” until the owner, client, or utility authority isolates any hazardous energy or deactivates the system and can demonstrate that condition.
- Where a line placement and depth is known or suspected and where there is potential for contact, hand digging, or hand auguring, instrumentation and other investigative techniques shall be used.

4.10.4 The One Call System Definition and Directory or its equivalent shall be used to prepare for excavation work in the event the identity of an underground installation(s) is unknown.

4.10.5 Line location documentation (or appropriate regional agency or company) provides a listing of companies that have registered buried facilities in the proposed work area. Some public utilities and private companies are not members of the One Call System. In order to give line operators sufficient time to respond to a request to locate, a minimum waiting period of 72 business hours is required prior to beginning work.

4.10.6 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines contained in this SOP or as contract-specified.

4.11 **Surface Markings**

4.11.1 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.

4.11.2 All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than two inches.

4.11.3 If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.

4.12 **Uniform Color-Coding**

4.12.1 The colors and corresponding installation type are as follows unless otherwise contract-specified.

4.12.2 Red: Electric Power Lines, Cables, Conduit, and Lighting Cables

4.12.3 Yellow : Gas, Oil, Stream, Petroleum, or Gaseous Materials

4.12.4 Orange : Communication, Alarm or Signal Lines, Cables, or Conduit

4.12.5 Green: Sewers and Drain Lines

4.12.6 White : Proposed Ground Disturbance area

4.12.7 Pink: Temporary Survey Markings

4.12.8 Purple: Nonpotable Water

5.0 **Records**

5.1 The following records on the identification of and response to underground utilities will be maintained in the project files:

5.1.1 All information regarding the identification of underground installations (this information can also be transferred to the appropriate drawings and/or prints and shall be available on site).

5.1.2 Drawings and/or prints shall be maintained for the life of this project.

5.1.3 Identifying Underground Installations Checklist.

6.0 **Attachments**

None.

5-507-Hazardous Materials Communication / WHMIS

1.0 Purpose and Scope

- 1.1 Provides a Hazard Communication Program so that Resolution employees are informed of the hazards of the chemicals to which they may be exposed in the course of their work by way of container labeling and other forms of warning, material safety data sheets (MSDS), and employee training.
- 1.2 This procedure applies to all Resolution JV Partner employees and operations.
- 1.3 The program applies to the use of any hazardous substances which are known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

2.0 Terms and Definitions

A complete list of definitions can be found in their entirety in the HMR, the TDG Regulations, and the IATA DGR.

- 2.1 **Acute Effect:** An adverse effect on the human body with immediate onset of symptoms.
- 2.2 **Article:** A manufactured item: (1) which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and, (3) which does not release or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.
- 2.3 **Carcinogen:** Those chemicals appearing in any of the following reference sources are established as carcinogens for hazard communication purposes:
- National Toxicology Program (NTP) Annual Report on Carcinogens.
 - International Agency for Research on Cancer (IARC) Monographs, Volumes 1-34. Note: The Registry of Toxic Effects of Chemical Substances published by NIOSH indicates whether a substance has been found by NTP or IARC to be a potential carcinogen.
- 2.4 **Chemical Name:** The scientific designation of a substance in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry or the system developed by the Chemical Abstracts Service.
- 2.5 **Chronic Effect:** An adverse effect on the human body with symptoms which develop slowly over a long period of time or which frequently recur.
- 2.6 **Combustible Liquid:** Any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C), or higher, the total volume of which makes up 99% or more of the total volume of the mixture.
- 2.7 **Common Name:** Any designation or identification such as code name, code number, trade name or brand name used to identify a substance other than by its chemical name.
- 2.8 **Container:** Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank or the like that contains a hazardous chemical. For purposes of this Safety Operating Procedure (SOP) and Occupational Safety and Health Administration (OSHA) standard, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.
- 2.9 **Establishment:** Any separate and distinct Resolution office, laboratory or other company facility.
- 2.10 **Exposure:** Any situation arising from work operations where an employee may ingest, inhale, absorb through the skin or eyes or otherwise come into contact with a hazardous substance.
- 2.11 **Flammable:** A substance that falls into one of the following categories:
- **Flammable Aerosol:** An aerosol that when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening or flashback (a flame extending back to the valve) at any degree of valve opening;
 - **Flammable Gas:** A gas that at ambient temperature and pressure:

- Forms a flammable mixture with air at a concentration of 13% of volume or less; or
 - Forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.
 - **Flammable Liquid:** Any liquid having a flash point below 100°F (37.8°C), except any mixture having components with flash points of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture.
 - **Flammable Solid:** A solid, other than a blasting agent or explosive as defined in 8 CCR 5237(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard.
 - A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.
- 2.12 **Flash Point:** Minimum temperature of a liquid at which it gives off sufficient vapors to form an ignitable mixture with the air near the surface of the liquid or within the container used.
- 2.13 **Hazardous Chemical:** Those chemicals appearing in any of the following reference sources are established as hazardous chemicals for hazard communication purposes.
- 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, OSHA.
 - Hazardous Products Act, R.C.S. 1985, c. H-3, section 2, Canada
 - For operations within the state of California, the list of hazardous substances prepared by the California Director of Industrial Relations pursuant to Labor Code Section 6382. The concentrations and footnotes, which are applicable to the list, shall be understood to modify the same substance on all other source lists or hazard determinations set forth in § 8 CCR 5194(d)(3)(B) and (d)(5)(D).
- 2.14 **Hazardous Substance:** A hazardous chemical or carcinogen, or a product or mixture containing a hazardous chemical or carcinogen provided that:
- The hazardous chemical is 1% or more of the mixture or product or 2% if the hazardous chemical exists as an impurity in the mixture; or
 - The carcinogen is 0.1% or more of the mixture or product.
 - Manufacturers, importers and distributors will be relied upon to perform the appropriate hazard determination for the substances they produce or sell.
- 2.15 The following materials are not covered by the Hazard Communication Standard:
- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.) when subject to regulations issued under that act by the Environmental Protection Agency.
 - Tobacco or tobacco products
 - Wood or wood products. Note: Wood dust is not exempt since the hazards of wood dust are not “self-evident” as are the hazards of wood or wood products
 - Consumer products (including pens, pencils, adhesive tape) used in the work place under typical consumer usage
 - Articles (i.e. plastic chairs)
 - Foods, drugs, or cosmetics intended for personal consumption by employees while in the work place
 - Foods, drugs, cosmetics in retail store packaged for retail sale
 - Any drug in solid form used for direct administration to the patient (i.e., tablets or pills)

- 2.16 **Hazardous Substance Inventory (HSI):** A listing of all chemicals stored or used at an office or project site. Note that the HSI may be imbedded in a project Health and Safety Plan.
- 2.17 **Immediate Use:** Means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.
- 2.18 **MSDS:** A material safety data sheet prepared pursuant to state and federal regulations, OSHA Form 174 and Canada regulations (Controlled Products regulations, schedule 1).
- 2.19 **MSDS Administrator:** The individual designated by the Office Manager to maintain the additional establishment-specific HSI and the MSDS binder required if that establishment uses or stores hazardous substances.
- 2.20 **NFPA:** A system of categories, colors and numbers was created to provide basic hazard information. It enables firefighters and other emergency personnel to easily decide whether or not to evacuate an area or proceed with emergency control operations. The three principal categories of identification are Health, Flammability and Instability. A numerical range of "0 to 4" indicates the severity of the hazard. A "4" indicates the most severe and a "0" indicates a minimal hazard.
- 2.21 **Mixture:** Any solution or intimate admixture of two or more substances which do not react chemically with each other.
- 2.22 **Reactivity:** A measure of the tendency of a substance to undergo chemical reaction with the release of energy.
- 2.23 **Solubility:** The ability of substance to blend and mix uniformly with another.
- 2.24 **Specific Gravity (density):** Ratio of the weight of a substance to the weight of the same volume of another substance. As used in this directive, specific gravity or density refers to the weight of substance as compared to the weight of an equal volume of water.
- 2.25 **Vapor Density:** The weight of a vapor-air mixture resulting from the vaporization of a volatile liquid at equilibrium temperature and pressure conditions, as compared with the weight of an equal volume of air under the same conditions.
- 2.26 **WHMIS:** The Workplace Hazardous Materials Information System (WHMIS) is Canada's national hazard communication standard. The key elements of the system are cautionary labelling of containers of WHMIS "controlled products", the provision of material safety data sheets (MSDSs) and worker education and training programs.

3.0 References

None.

4.0 Procedure

- 4.1 All employees have a right to, and should, know the properties and potential hazards of substances to which they may be exposed.
- 4.2 Should Resolution assign employees that do not read and speak English to tasks with chemical exposures, communications will be provided in the language understood by that employee.
- 4.3 **Hazardous Waste Exemption**
- 4.3.1 In the U.S., hazardous wastes are excluded from the state and federal Hazard Communication standards. However, Resolution employees who handle or are otherwise exposed to hazardous wastes are covered by the requirements of the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 – Hazardous Waste Operations And Emergency Response. This standard requires that:
- Employees receive 40-hour initial and 8-hour annual SH&E training; and that
 - Information on the hazards of hazardous wastes be documented in a site-specific Health and Safety Plan (HASP) and communicated to all employees in site-specific briefing on-site training required by the standard.

- 4.3.2 Therefore, Resolution HAZWOPER projects are not required to comply with the requirements of this SOP as they relate to the hazardous wastes that are present at those project sites.
- 4.3.3 A Resolution's HASP requirements are specified in *5-509-Hazardous Waste Operations and Emergency Response*.
- 4.4 **Hazardous Substance Inventory**
- 4.4.1 Establishment-Specific HSI
- If an Resolution establishment uses or stores additional hazardous substances, an establishment-specific HSI must be maintained at that establishment.
 - If it is determined that an office-specific HSI is needed, the Resolution **Office Manager** shall assure that one is developed and maintained by someone appointed as the establishment's MSDS Administrator.
 - The content of the office-specific written inventory shall be updated as new hazardous substances are procured for, or removed from, the establishment and shall be verified by the **Regional SH&E Manager** through regular inspections of the establishment.
 - In order to meet the 30-years-after-employment-termination record retention requirement, the office-specific HSIs shall be treated as a permanent record.
- 4.5 **Material SAFETY Data Sheets**
- 4.5.1 Establishment-Specific MSDS Inventory
- If it is determined that an Resolution establishment is required to maintain an establishment-specific HSI ,MSDSs for those specific hazardous substances must be maintained on file at that establishment.
 - The **Regional SH&E Manager** shall audit the local office program for MSDS request and maintenance and report deficiencies to the appropriate management level, as necessary, to assure compliance with this SOP.
- 4.5.2 Field Project Sites and Client Facilities
- The **Project Manager** and/or the **Site Safety Officer** shall access or obtain, and maintain copies of MSDS from:
 - All Resolution subcontractors bringing chemicals onto the project site; and
 - The client, for all of the client's chemicals to which Resolution or Resolution subcontract employees are potentially exposed.
- 4.5.3 Employee Access to MSDSs
- MSDSs should be maintained at the local establishment that uses that hazardous substance. Copies of the MSDS should be made available to the employee upon request to the office's MSDS Administrator.
- 4.5.4 Field Access to MSDSs
- When hazardous substances are brought into the field, the user must assure that a copy of the MSDS for that substance accompanies it and is available at the field location where it is to be used.
- 4.5.5 MSDSs for Resolution Products
- It is unlikely that Resolution activities would create a chemical for which a new MSDS were needed. If such a chemical were created, the Corporate SH&E Department shall work with the appropriate operations groups to draft, review, and publish the new MSDS.
- 4.5.6 Content of the Material Safety Data Sheet
- As a minimum, the MSDS must contain the following information:
 - The name, address, and telephone number of the source of the product or material, preferably those of the manufacturer
 - The trade name and synonyms of the product or material

- Chemical names of hazardous ingredients, including, but not limited to, those in mixtures
- An indication of the percentage, by weight or volume, which each ingredient of a mixture bears to the whole mixture
- Physical data pertaining to the product or material, including boiling point (in °F); vapor pressure (in mm of mercury); vapor density of gas or vapor (air = 1); solubility in water (in percent by weight); specific gravity of material (water = 1); percentage volatile by volume (at 70 °F); evaporation rate for liquids (either butyl acetate or ether may be taken as 1); and appearance and odor
- Fire and explosion hazard data pertaining to the product or material, including flash point (in °F); flammable limits (in percent by volume in air); suitable extinguishing media or agents; special fire fighting procedures; and unusual fire and explosion hazard information
- Health hazard data pertaining to the product or material, including exposure limits, effects of overexposure and medical conditions aggravated by exposure, and emergency and first-aid procedures
- Reactivity data, including stability, incompatibility, hazardous decomposition products, and hazardous polymerization
- Procedures to be followed and precautions to be taken in cleaning up and disposing of materials leaked or spilled
- Special protection information, including use of personal protective equipment, such as respirators, eye protection, and protective clothing, and ventilation or other control measures
- Special precautionary information about handling and strong
- Any other general precautionary information
- MSDSs that do not contain this information shall be returned to the distributor or manufacturer to be updated.

4.5.7 Trade Secrets

- Some hazardous substance suppliers may claim the information requested on MSDSs is proprietary and not provide the information to Resolution.
- When MSDSs supplied to the Resolution Regional SH&E Manager indicate that proprietary information has been withheld, the Regional SH&E Manager will either obtain the necessary information to make a hazard assessment or reject the material for use within Resolution.

4.6 Labeling

4.6.1 Containers of hazardous substances used or stored in each Resolution establishment must be labeled, tagged or marked with the following information:

- Identification of the hazardous substance(s)
- Appropriate hazard warnings
- Name and address of the manufacturer, importer or other responsible parties
- Safe Handling Instructions
- Statement that an MSDS is available for the product

4.6.2 Labels on containers shall not be removed or defaced. Labels or other forms of warning shall be legible, in English and French (Canada), and prominently displayed on the container.

4.6.3 Any failure to have the appropriate labeling information on a container at any time will be cause to suspend use of the product until the container is properly labeled.

4.6.4 Carcinogen Labeling

- Chemicals which have been indicated as positive or suspect carcinogens by either OSHA, ACGIH, the International Agency for Research on Cancer (IARC) (World Health Organization), or the National Toxicology Program (NTP) will be considered to be carcinogenic for purpose of the HCS. Those chemicals identified as being “known to be carcinogenic” by NTP must have carcinogen warnings on the label and information on the MSDSs.

4.6.5 Stationary Process Containers

- If there is stationary process equipment within a work area, signs, placards, process sheets, batch tickets, operating procedures, or other such written materials may be used in lieu of fixed labels on the containers, as long as the alternative method conveys the appropriate hazard information. The written materials shall be readily accessible to the employees in the work area.

4.6.6 Portable Containers

- Portable containers of hazardous substances need not be labeled when the substance is transferred from labeled containers and is intended for immediate use of the employee who performs the transfer.
- Containers of hazardous substances transferred from labeled containers and not intended for the immediate use of the employee performing the transfer shall be labeled with the chemical name and a hazard warning label in accordance with the National Fire Protection Association's (NFPA) 704M Hazard Identification System shall be attached.

4.7 Chemical Storage

4.7.1 Hazardous chemicals are to be stored in their original, labeled containers with the lids securely closed and taped if possible. Flammable and combustible materials must be stored in fire impervious cabinets in designated stockroom areas. Chemicals must be stored in compliance with instructions provided on their labels, MSDS, or the manufacturer's specifications.

4.7.2 All hazardous chemicals must be stored in a manner that prevents spillage and leakage from exposing people or the environment to the chemical.

4.7.3 Hazardous chemicals shall not be stored with foods or beverages. Food and beverages shall not be consumed in areas where hazardous chemicals are used or stored.

4.8 Chemical Use in Offices

4.8.1 In general, hazardous substances should not be taken into office areas, conference rooms, or break areas. If this general requirement is infeasible, contact the SH&E Department for guidance.

4.8.2 General exceptions to this rule are the following:

- Liquid paper
- Toner
- Cleaners
- Isobutylene calibration gas
- pH calibration solutions for instruments

4.9 Employee Information and Training

4.9.1 Each Resolution employee who handles or is exposed to hazardous substances must be provided information and training on hazardous substances in their work area.

- At the time of their initial assignment
- Whenever a new hazard is introduced into their work area

4.9.2 As a minimum, the training requirements apply to Resolution personnel in the following job categories:

- All personnel who perform field work that involves the use of, or potential exposure to, hazardous substances
- Laboratory Employees

4.10 Initial Training Content

4.10.1 The Initial Training will provide instruction in the following:

- Methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (such as personal monitoring, visual appearance or odor of hazardous substances being released, etc.);

- The physical and health hazards of substances in the work area and measures and procedures Resolution has implemented to protect employees; and
 - The details of this hazard communication program (SOP), including an explanation of the labeling system and the MSDS, and how he/she can obtain and use appropriate hazard information.
- 4.10.2 The Initial Training will also inform the employee of the following:
- Any operations in their work area in which hazardous substances are present
 - Location and availability of this written hazard communications program (SOP)
 - Their right to personally receive information regarding hazardous substances to which they may be exposed
 - Their right to have their physician receive information regarding hazardous substances to which they may be exposed
 - Their right against discharge or other discrimination (in California) due to the employee's exercise of rights afforded pursuant to provisions of the California Hazardous Substances Information and Training Act
- 4.11 **Periodic Training and Training for Non-Routine Tasks**
- 4.11.1 Additional training will be provided to employees who have received initial training whenever:
- A new hazardous substance is introduced into their work area
 - A new or revised MSDS is received, which indicates significantly increased risks to employee health as compared to those stated on the previous MSDS
 - Non-routine tasks are performed, which will potentially result in exposure to hazardous substances, or exposure under circumstances, which were not addressed during initial training
- 4.11.2 Supervisors, in coordination with their **Regional SH&E Manager**, shall provide such training through an explanation of the information on the contents of the MSDS for that substance.
- 4.11.3 When training their employees, supervisors shall explain:
- Any health hazards associated with use of the substance or mixture
 - Proper precautions for handling
 - Necessary personal protective equipment or other safety precautions to prevent or minimize exposure
 - Emergency procedures for spills, fire, disposal, and first aid
- 4.11.4 For most projects involving field work, this periodic training requirement will be facilitated through the implementation of the site specific HASP that has been developed for the project.

4.12 **Documentation of Initial and Periodic Training**

4.12.1 All training required by this SOP shall be documented at the time it is performed by having the employee sign a copy of a training attendance sheet.

4.13 **Chemical Usage**

4.13.1 Prior to using any chemical, a Task Hazard Analysis (THA) shall be completed by the employees assigned to use the chemical. The analysis will identify the hazards associated with the tasks to be performed and prescribe the Personal Protective Equipment (PPE) to be used.

4.14 **Office Specific Written Program**

4.14.1 Each office or location using or storing hazardous materials will develop a written office/ location-specific Hazard Communication/WHMIS Program. If the local office decides to implement the requirements of the standard in any way that differs from this procedure, they shall verify the changes with the SH&E department, document the changes, and communicate the differences to all affected employees.

4.14.2 For Canadian operations, all relevant MSDS must be current (no more than 3 years) and readily available (in French and English) for all hazardous materials.

4.15 **Canada-specific**

4.15.1 Consumer products are exempt from supplier labels and MSDS requirements. Some cleaning solvents may be packaged as consumer products and these must be labelled in accordance with the Consumer Product Act requirements.

4.15.2 In addition to the labelling of storage containers in the workplace, the contents of process piping (including valves), process vessels and reaction vessels are required to be identified through the use of colour coding, labels, placards or other modes of identifications that must be communicated to workers through training programs. It is very important for employees to be aware of and understand Client labelling requirements for these types of process systems.

4.16 **Roles and Responsibilities**

4.16.1 **Regional SH&E Managers will:**

- Audit their regional offices to assure that they maintain an establishment-specific Hazardous Substance Inventory (HSI).
- Audit their regional offices to assure that if an establishment-specific HSI is required, that MSDSs are available for each substance listed on the HSI.
- Provide interpretation of MSDSs and hazard information for HMIS labels/NFPA labels and other information to assist in training employees.
- Provide hazard communication training to Resolution employees and file documents of this training in the Corporate SH&E office.
- Review MSDS for adequacy of completion to meet the OSHA and Canadian standard and returning them to supplier, if necessary.

4.16.2 **Office Managers will:**

- Have an operations-specific, written hazard communication program which at least describes how the requirements of this Procedure and the US OSHA and Canadian Hazard Communication requirements for labels and other forms of warning, material safety data sheets, and employee information and training will be met.
- Appoint an MSDS administrator for their establishment if they store or use hazardous substances.
- Confirm, if required, that the MSDS Administrator maintains an HSI for their establishment.
- Confirm that MSDS are available for all substances listed on their establishment's HSI.
- Confirm that a copy of this Procedure and the site-specific MSDS are available to all employees. Employees shall be instructed in the location of this Procedure and the MSDS.
- Confirm that all employees in their office affected by the HAZCOM standard are provided with the appropriate training, including new employees.

- 4.16.3 **Project Managers (field task managers, supervisors) will:**
- Confirm that all employees under their supervision have received the initial and periodic training required by this SOP prior to assigning employees to tasks involve the use of, or potential exposure to, hazardous substances.
 - Notify employees of hazardous substances covered by this SOP that are used in their work area.
 - Determine the potential fire, toxic, or reactivity hazards which are likely to be encountered in the handling or utilization of a hazardous substance and will communicate this information to their affected employees, before any are permitted to work with it.
 - Confirm that an MSDS is available for each hazardous substance used, or potentially encountered, in the work areas or on the projects that are under their supervision.
 - Notify subcontractors (working for Resolution) of any hazardous substances that are used or stored by Resolution to which the subcontractor's employees may be exposed.
 - Notify clients or property owner/operators of chemicals brought onto their property by Resolution or Resolution's subcontractors.
 - Request MSDSs from all subcontractor organization for the relevant chemicals they bring onto an Resolution controlled site.
- 4.16.4 **Employees will:**
- Confirm that they have received appropriate hazard communication training prior to working with materials that fall under the standard.
 - Only work with materials for which they have been instructed on how to find an MSDS and how to work with that material safely.
 - Provide a copy of all MSDSs received to the MSDS Administrator at their facility.
 - Verify that an MSDS is available in their work area for each hazardous substance that they use.
 - Confirm that containers of hazardous substances that they use are properly labeled.

5.0 Records

None.

6.0 Attachments

None.

5-510-Hearing Conservation Program

1.0 Purpose and Scope

- 1.1 Establishes procedures to confirm that personal noise exposure remains within acceptable limits and establishes the requirements of an acceptable hearing conservation program.
- 1.2 This procedure applies to all Resolution Consultants North America-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Decibel (dB):** Logarithmic unit of measurement of sound level.
- 2.2 **Action Level:** An eight-hour, time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a noise dose of 50 percent.
- 2.3 **Standard Threshold Shift (STS):** When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear).
- 2.4 **Noise Reduction Rating (NRR):** The measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency.

3.0 References

None.

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Regional SH&E Managers or their designate

- Provide access to initial and refresher hearing conservation training.
- Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level.
- Designate areas and tasks where employees' exposure is at or above the action level.
- Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts.

4.1.2 Project or Office Managers

- Implement the hearing conservation program.
- Confirm that a hazardous noise assessment/evaluation has been conducted.
- Confirm that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Implement engineering controls to reduce noise levels when such measures are considered feasible and when required by regulation.
- Purchase, monitor, and replenish for employees' use a supply of hearing protection devices with a minimum Noise Reduction Rating (NRR) of 26 dBA.
- Confirm that individuals included in the program receive training and that the training meets the criteria outlined in this program.
- Investigate and implement corrective action to all reports of nonconformance with this procedure, including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas.



4.1.3 **Supervisors**

- Maintain an awareness of the noise levels in work areas for which he/she is responsible.
- Place warning signs in areas where sound levels would require the use of hearing protectors.
- Request that a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Confirm that all employees are aware of the requirements for hearing protection for any designated area or task.
- Enforce the use of hearing protection by employees in designated areas and for designated tasks.

4.1.4 **Employees**

- Comply with the requirements of the Hearing Conservation program.
- Wear hearing protection devices in designated areas or for designated tasks.
- Inspect and maintain hearing protection devices.
- Report any suspected change in noise levels of work area to supervisor.
- Report any signs or symptoms experienced that could be the result of overexposure to noise to supervisor.
- Participate in audiometric testing and hearing protection training when required.

4.2 **Requirements**

4.2.1 The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

Table 1. Permissible Exposure Limit

SOUND LEVEL (dBA)	TIME (hours)
85	8
90	4
95	2
100	1
105	0.5
110	0.25
115	0.125

4.2.2 Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below and PELs described in Table 1 are calculated without regard to the protection afforded by the use of hearing protectors.

Table 2. Action Levels for Hearing Conservation Program

SOUND LEVEL (dBA)	TIME (hours)
85	4
90	2
95	1
100	0.5
105	0.25



4.3

110	0.125
115	0.0625

Training Program

4.3.1 All employees with potential exposure above the action levels established in Table 2 of this procedure or who otherwise utilize any type of hearing protector will participate in a hearing conservation training program.

4.3.2 Training Objectives

4.3.3 The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise, and symptoms of overexposure to hazardous noise.
- When and/or where hearing protectors are required to be worn.
- The purpose of hearing protectors.
- The advantages, disadvantages, and effectiveness of various types of protectors.
- Instructions on how to select, use, fit, and care for hearing protectors.
- The purpose of audiometric testing, including an explanation of the test procedures.
- Hearing Conservation Program requirements and responsibilities.

4.3.4 Hearing protection training is conducted biannually for all affected employees or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

4.4 Audiometric Testing

4.4.1 All Resolution Consultants personnel with exposure greater than the action level may be enrolled in the medical surveillance program and undergo a baseline audiogram. Thereafter, annual audiograms will be compared with the baseline exam.

4.4.2 Enrolled employees will receive audiograms during their exit physicals.

4.4.3 When a Standard Threshold Shift (STS), as identified by the Resolution Consultants Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:

- A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.
- If the STS persists, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA.
- The employee will be counseled and Resolution Consultants will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology.
- Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
- The employee will be notified in writing by either the SH&E Department or the Resolution Consultants Medical Provider of the STS, within 21 days of determination, as required by regulation.
- The employee's supervisor will be notified of the shift in hearing threshold.

4.4.4 If the employee who has experienced an STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.

4.5 Monitoring of Noise Levels

4.5.1 As deemed necessary by an SH&E Professional, or a Project Health and Safety Plan, Resolution Consultants will periodically monitor personal and area noise levels using noise dosimetry and/or sound level meters.



4.6 Hearing Protectors

4.6.1 Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above. Additional information relative to hearing protector use is as follows:

- Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than four feet from you and/or when within 25 feet of an operating piece of heavy equipment.
- Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.
- Hearing protectors will be made available to all employees who may be exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for any period of time and who have experienced an STS.

5.0 Records

5.1.1 Noise exposure measurement records will be retained for three years at the project/facility.

5.1.2 Audiogram records will be retained in the employee's medical records as per Resolution Consultants' Medical Surveillance Procedure for a period as directed by regulation or Resolution Consultants' Medical Provider.

5.1.3 Employee training session documentation will be retained for the duration of employment.

6.0 Attachments

6.1 5-510-Specific Hearing Conservation Program

6.2 5-510-Hearing Protection Guidelines

5-511 Heat Stress Prevention

1.0 Purpose and Scope

- 1.1 Establishes a heat stress prevention program to help ensure that employees know and recognize the symptoms of heat stress-related illnesses and are prepared to take appropriate corrective action.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 **Acclimated:** Workers who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.
- 2.2 **Chemical Protective Clothing (CPC):** Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the worker with potentially hazardous materials in the workplace. Such materials include: Tyvek® coveralls (all types) and polyvinyl chloride (PVC) coveralls and rain suits.
- 2.3 **Unacclimated:** Workers who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.
- 2.4 **Heat Cramps:** A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.
- 2.5 **Heat Exhaustion:** A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.
- 2.6 **Heat Rash:** A heat-induced condition characterized by a red, bumpy rash with severe itching.
- 2.7 **Heat Stress.** The combination of environmental and physical work factors that constitute the total heat load imposed on the body.
- 2.8 **Heat Stroke:** The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.
- 2.9 **Sunburn:** Is caused by unprotected exposure to ultraviolet light that is damaging to the skin. The injury is characterized by red painful skin, blisters, and/or peeling.

3.0 References

- 3.1 5-003-SH&E Training
- 3.2 5-208-Personal Protective Equipment
- 3.3 5-314-Working Alone and Remote Travel

4.0 Procedures

4.1 Restrictions

- 4.1.1 Staff working in extreme heat or sun for extended periods of time away from a shelter or vehicle must not work alone.
- 4.1.2 Staff shall not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.
- 4.1.3 Clothing corrections shall be applied in accordance with the heat stress and strain section of the ACGIH Standard.

4.2 Roles and Responsibilities

- 4.2.1 Project Managers/field task managers' responsibilities:

- Evaluate the need for heat stress prevention measures and incorporate as appropriate into the Health and Safety Plan.
 - Implement heat stress prevention measures, as applicable, at each work site.
 - Develop/coordinate a work-rest schedule, as applicable.
 - Ensure heat stress hazard assessments/evaluations were completed for the planned activities.
 - Assign personnel physically capable of performing the assigned tasks.
 - Ensure that personnel are properly trained in the recognition of heat stress-related symptoms.
- 4.2.2 SH&E Managers' responsibilities:
- Provide heat stress awareness training.
 - Assist project teams develop appropriate work-rest schedules.
 - Conduct/support incident investigations related to potential heat stress-related illnesses.
- 4.2.3 Site Supervisors' responsibilities:
- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned employees.
 - Ensure that employees have been trained on the recognition of heat stress-related illness.
 - Ensure that adequate supplies of appropriate fluids are readily available to employees.
 - Ensure that a proper rest area is available.
 - Conduct heat stress monitoring, as applicable.
 - Implement the work-rest schedule.
 - Ensure that first aid measures are implemented once heat stress symptoms are identified.
 - Ensure personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
 - Report all suspected heat stress-related illnesses.
- 4.2.4 Employees' responsibilities:
- Observe each other for the early symptoms of heat stress-related illnesses.
 - Maintain an adequate intake of available fluids.
 - Be familiar with heat stress hazards, predisposing factors, and preventative measures.
 - Report to work in a properly vested and hydrated condition.
 - Report all suspected heat stress-related illnesses.
- 4.3 **Controls**
- 4.3.1 If staff are or may be exposed, the supervisor shall:
- Conduct a heat stress assessment to determine the potential for hazardous exposure of workers, and
 - Develop and implement a heat stress exposure control plan.
- 4.3.2 If staff are or may be exposed, the supervisor shall implement engineering controls (e.g., shelters, cooling devices, etc.) to reduce the exposure of staff to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.
- 4.3.3 If engineering controls are not practicable, the supervisor shall reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.
- 4.3.4 If staff are or may be exposed, the supervisor shall provide and maintain an adequate supply of cool, potable water close to the work area for the use of a heat exposed worker.
- 4.3.5 If a staff person shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant, if available, or by a physician.

- 4.3.6 Heat stress can be a significant field site hazard, especially for workers wearing CPC. The workforce will gradually work up to a full workload under potentially stressful conditions to allow for proper acclimation.
- 4.3.7 Site personnel shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Workers must be encouraged to immediately report any heat stress that they may experience or observe in fellow workers. Supervisors must use such information to adjust the work-rest schedule to accommodate such problems.
- 4.3.8 Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow workers to loosen or remove protective clothing, and sufficient seating should be available for all personnel. During breaks, workers must be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.
- 4.4 **Symptoms and Treatment**
- 4.4.1 Workers who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin), shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.
- 4.4.2 Anyone exhibiting symptoms of heat stroke (red, dry skin, or unconsciousness) must be taken immediately to the nearest medical facility, taking steps to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).
- 4.4.3 Severe heat stress (heat stroke) is a life-threatening condition that must be treated by a competent medical authority.
- 4.5 **Prevention**
- 4.5.1 All staff working in extreme heat or sun should understand the following guidelines for preventing and detecting heat exhaustion and heat stroke.
- If you experience heat exhaustion or heat stroke you must immediately seek shelter and water.
 - Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
 - Try to schedule work for the coolest part of the day, early morning and evening.
- 4.5.2 Prevention of heat-related illnesses:
- Avoid strenuous physical activity outdoors during the hottest part of the day.
 - Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
 - Avoid sudden changes of temperature. Air out a hot vehicle before getting into it.
 - If you take diuretics, ask your doctor about taking a lower dose during hot weather.
 - Drink 8 to 10 glasses of water per day. Drink even more if you are working or exercising in hot weather.
 - Avoid caffeine and alcohol as they increase dehydration.
 - If you exercise strenuously in hot weather, drink more liquid than your thirst seems to require.
- 4.6 **Personal Protective Equipment**
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
 - Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
 - Wear sunglasses with UV protection.
 - Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).
- 4.7 **Work-Rest Schedule Practices**
- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
 - Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz. per hour during the work shift; fluid replacement at frequent intervals is most effective.

- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.
- Dry clothing or towels will be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
 - Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
 - Erecting a cover or partition to shade the work area.
 - Wearing cooling devices such as vortex tubes or cooling vests beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

4.8 **Evaluating the Work-Rest Schedule's Effectiveness**

4.8.1 Once a work-rest schedule is established, the work supervisor must continually evaluate its effectiveness through observation of workers for signs/symptoms of heart stress. Measurement of each worker's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

4.8.2 At the start of the workday each worker's baseline pulse rate (in beats per minute – bpm) is determined by taking a pulse count for 15 seconds and multiplying the result by four or an automated pulse count device may be utilized. Worker pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- Each worker's maximum heart rate at the start of any break should be less than [180 minus worker's age] bpm. If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.
- At the end of each work period all workers' heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be remeasured and the end-of-break criteria again applied.

4.8.3 Use a clinical thermometer or similar device to measure the oral/ear temperature at the beginning (before drinking liquids) and end of each break period and apply the following criteria:

- If the oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period.
- If the oral temperature still exceeds 99.6°F (36.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.

4.8.4 Use of an automated or similar blood pressure device will be used to assess each employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an employee is outside of 90/60 to 150/90, then the employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be remeasured and the end-of-break criteria again applied.

4.8.5 All physiological monitoring of heat stress will be documented using *5-511-Heat/Cold Stress Monitoring Log*.

4.9 **Training**

4.9.1 Project staff and their supervisors that may be exposed to the hazard will be oriented to the hazard and the controls prior to work commencing.

4.9.2 Those personnel potentially exposed to heat stress will receive training including, but not limited to

- Sources of heat stress, influence of protective clothing, and importance of acclimatization.
- How the body handles heat.
- Recognition of heat-related illness symptoms.
- Preventative/corrective measures.
 - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
 - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses.

5.0 Records

None.

6.0 Attachments

6.1 5-511-FM Heat/Cold Stress Monitoring Log



5-511 Form 1 Heat Stress Monitoring Log

The purpose of this form is to track entry into hot zones wearing chemically protective clothing and monitor employees for heat stress-related illness. It is the responsibility of the foreman or supervisor-in-charge to ensure that each person entering the hot zone completes the required information. Vital signs must be taken by a competent person.

Project Name:			Foreman/Supervisor:					Work/Rest Schedule1:				IN (min)	OUT (min)			
Date:	Water Provided ²		Acclimated ³		Initial Vitals ³	Vital Signs and Time In/Out ⁴										
Employee Name	Yes	No	Yes	No	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		

1. Please refer to 5-511 Heat Stress. Section 6.3 provides specific details on how to develop a work-rest schedule.
2. Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
3. A worker is "acclimated" if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If a worker is acclimated, check "Yes." If a worker is not acclimated, check "No" and reduce the "Min In" by 50 percent for that employee until the 7- to 10-day period is reached.
4. "Vitals" refers to employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work operations in the hot zone. Each time the employee exits the hot zone, vitals must be taken and evaluated for heat stress criteria. Section 6.4 of 5-511 Heat Stress provides specific instructions for taking and evaluating employee vital signs.
5. Body temperature vital signs will be recorded in °F.

Attachment D
Material Safety Data Sheets

EMERGENCY NUMBERS:

(USA) CHEMTREC : 1(800) 424-9300 (24hrs)

(CAN) CANUTEC : 1(613) 996-6666 (24hrs)

(USA) Anachemia : 1(518) 297-4444

(CAN) Anachemia : 1(514) 489-5711

WHMIS	Protective Clothing	TDG Road/Rail
WHMIS CLASS: B-2 D-1A		TDG CLASS: 3 PIN: UN1279 PG: II
		

Section I. Product Identification and Uses

Product name	1,2-DICHLOROPROPANE	CI#	Not available.
Chemical formula	CH ₃ CH(Cl)CH ₂ Cl	CAS#	78-87-5
Synonyms	alpha, beta-Dichloropropane, Propylene chloride, Propylene dichloride, AC-3210, 32798	Code	AC-3210
Supplier	Anachemia Canada. 255 Norman. Lachine (Montreal), Que H8R 1A3	Formula weight	112.99
		Supersedes	
Material uses	For laboratory use only.		

Section II. Ingredients

Name	CAS #	%	TLV
1) 1,2-DICHLOROPROPANE	78-87-5	99	Exposure limits: ACGIH TWA 10 ppm

Toxicity values of the hazardous ingredients

1,2-DICHLOROPROPANE:

ORAL (LD50): Acute: 1900 mg/kg (Rat). 860 mg/kg (Mouse). 2000 mg/kg (Guinea pig).

DERMAL (LD50): Acute: 8750 mg/kg (Rabbit).

 VAPOR (LC50): Acute: 14000 mg/m³ (Rat) (8 hour(s)).

Section III. Physical Data

Physical state and appearance / Odor	Colorless liquid. Chloroform odor.
pH (1% soln/water)	Not applicable.
Odor threshold	Not available.
Percent volatile	100% (V/V)
Freezing point	-100°C
Boiling point	95 to 96°C
Specific gravity	1.156 (Water = 1)
Vapor density	3.89 (Air = 1)
Vapor pressure	40 (100) mm Hg @ 19.4°C (39.4°C)
Water/oil dist. coeff.	Not available.
Evaporation rate	Not available.
Solubility	Insoluble in cold water.

Section IV. Fire and Explosion Data

Flash point	CLOSED CUP: 4°C
Flammable limits	LOWER: 3.4% UPPER: 14.5%
Auto-ignition temperature	556°C
Fire degradation products	Oxides of carbon (CO, CO ₂). Hydrogen chloride. Phosgene.
Fire extinguishing procedures	Use DRY chemical, carbon dioxide, or alcohol-resistant foam. Water may be ineffective to extinguish fires. Wear adequate personal protection to prevent contact with material or its combustion products. Self contained breathing apparatus with a full facepiece operated in a pressure demand or other positive pressure mode. Cool containing vessels with flooding quantities of water.
Fire and Explosion Hazards	Flammable liquid. Vapor may travel considerable distance to source of ignition and flash back, eliminate all sources of ignition. Vapor forms explosive mixture with air. Container explosion may occur under fire conditions or when heated. Contact with oxidizers may cause fire and/or explosion. Emits toxic fumes under fire conditions.

Section V. Toxicological Properties

Routes of entry	Inhalation and ingestion. Eye contact. Skin contact. Skin absorption.
Effects of Acute Exposure	Harmful by ingestion, inhalation or skin absorption. Irritant. Narcotic. Prolonged contact can cause nausea, headache, vomiting, and central nervous system depression. Exposure to and/or consumption of alcohol may increase toxic effects. Target organs: heart, blood, central nervous system, liver, kidneys, eyes, skin, respiratory system. 400 ppm (1,2-DICHLOROPROPANE) is immediately dangerous to life or health.
Eye	Causes irritation.
Skin	Causes skin irritation. Repeated or prolonged skin contact may cause dermatitis. May be absorbed through the skin.
Inhalation	Material is irritating to mucous membranes and upper respiratory tract. May cause central nervous system depression (headache, nausea, vomiting, incoordination, etc.), drowsiness, liver and kidney damage.
Ingestion	Causes gastrointestinal irritation. May cause headache, nausea, vomiting, loss of consciousness, liver and kidney damage.

Effects of Chronic Overexposure May cause liver, kidney, brain, blood (anemia) and heart damage. Possible carcinogen. In vitro studies in mammal cells have shown mutagenic action. Teratogenic effects: Not available. Toxicity of the product to the reproductive system: Not available. To the best of our knowledge, the chemical, physical, and toxicity of this substance has not been fully investigated.

Section VI. First Aid Measures

Eye contact Immediately flush eyes with copious quantities of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Call a physician.

Skin contact Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash contaminated clothing before reusing.

Inhalation Remove patient to fresh air. Administer approved oxygen supply if breathing is difficult. Administer artificial respiration or CPR if breathing has ceased. Call a physician.

Ingestion If conscious, wash out mouth with water. Never give anything by mouth to an unconscious or convulsing person. Call a physician.

Section VII. Reactivity Data

Stability Stable. Conditions to avoid: High temperatures, sparks, open flames and all other sources of ignition, contamination.

Hazardous decomp. products Not available.

Incompatibility Oxidizing agents, acids, bases, water, metals (zinc, sodium, potassium, aluminum and their alloys, etc.), o-dichlorobenzene, 1,2-dichloroethane.

Reaction Products Can undergo an exothermic reaction with aluminum. Hazardous polymerization will not occur.

Section VIII. Preventive Measures

1,2-DICHLOROPROPANE

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Protective Clothing in case of spill and leak Wear self-contained breathing apparatus, rubber boots and heavy rubber gloves.

Spill and leak Evacuate the area. Eliminate all sources of ignition. Absorb on sand or vermiculite and place in a closed container for disposal. Use non-sparking tools. Ventilate area and wash spill site after material pick up is complete. DO NOT empty into drains. DO NOT touch spilled material. Runoff to sewer may create fire or explosion hazard.

Waste disposal Burn in a chemical incinerator equipped with an after burner and scrubber. According to all applicable regulations.

Storage and Handling Store in a cool place away from heated areas, sparks, and flame. Store in a well ventilated area. Store away from incompatible materials. Do not add any other material to the container. Do not wash down the drain. Do not breathe gas/fumes/vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. Keep away from direct sunlight or strong incandescent light. Keep container tightly closed and dry. Manipulate under an adequate fume hood. Take precautionary measures against electrostatic discharges. Ground the container while dispensing. Ground all equipment containing material. Use explosion proof equipment. Use non-sparking tools. Watch for accumulation in low confined areas. Empty containers may contain a hazardous residue. Handle and open container with care. Take off immediately all contaminated clothing. This product must be manipulated by qualified personnel. Do not get in eyes, on skin, or on clothing. Wash well after use. In accordance with good storage and handling practices. Do not allow smoking and food consumption while handling. Do not use handling equipment or containers composed of magnesium, aluminum or their alloys. If you feel unwell, seek medical advice (show the label when possible).

Section IX. Protective Measures

Protective clothing Splash goggles. Impervious gloves, apron, coveralls, and/or other resistant protective clothing. Sufficient to protect skin. A OSHA/MSHA jointly approved respirator is advised in the absence of proper environmental controls. If more than TLV, do not breathe vapor. Wear self-contained breathing apparatus. Do not wear contact lenses. Make eye bath and emergency shower available. Ensure that eyewash station and safety shower is proximal to the work-station location.

Engineering controls Use in a chemical fume hood to keep airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Do not use in unventilated spaces.

Section X. Other Information

Special Precautions or comments Flammable liquid! Possible mutagen/ carcinogen! Harmful liquid! Irritant! Do not breathe vapor. Avoid all contact with the product. Avoid prolonged or repeated exposure. Use in a chemical fume hood. Keep away from heat, sparks and flame. Use non-sparking tools. To the best of our knowledge, the chemical, physical and toxicity of this substance has not been fully investigated. Do not use handling equipment or containers composed of magnesium, aluminum or their alloys. Handle and open container with care. Container should be opened only by a technically qualified person.
Synergistic materials: Exposure to and/or consumption of alcohol may increase toxic effects.
RTECS NO: TX9625000 (1,2-Dichloropropane).



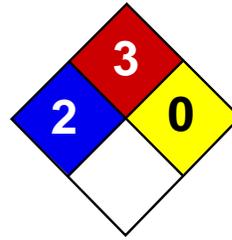
NFPA

Prepared by MSDS Department/Département de F.S..

Validated 10-Jun-2013



While the company believes the data set forth herein are accurate as of the date hereof, the company makes no warranty with respect thereto and expressly disclaims all liability for reliance thereon. Such data are offered solely for your consideration, investigation and verification.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. **MUTAGENIC EFFECTS:** Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:

Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powerful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Vigorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction

of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimanganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m³) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m³) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m³) [Canada] TWA: 0.5 (ppm) [Canada] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:

Aromatic. Gasoline-like, rather pleasant. (Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:

Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimanganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. **MUTAGENIC EFFECTS:** Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. **DEVELOPMENTAL TOXICITY:** Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:

Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia) Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism, and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients

for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

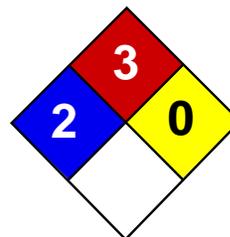
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:35 PM

Last Updated: 11/01/2010 12:00 PM

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C₈H₁₀

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD50): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (irritant, sensitizer). CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:

CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001) CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001) CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:

Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States] TWA: 435 STEL: 545 from OSHA (PEL) [United States] TWA: 435 STEL: 545 (mg/m³) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States] TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)] TWA: 100 STEL: 125 (ppm) [Belgium] TWA: 100 STEL: 125 (ppm) [Finland] TWA: 50 (ppm) [Norway] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; $\log(\text{oil/water}) = 3.1$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:

Easily soluble in diethyl ether. Very slightly soluble in cold water or practically insoluble in water. Soluble in all proportions in Ethyl alcohol. Soluble in Carbon tetrachloride, Benzene. Insoluble in Ammonia. Slightly soluble in Chloroform. Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:

Can react vigorously with oxidizing materials. Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:

Lethal Dose/Conc 50% Kill: LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg Lowest Published Lethal Dose/Conc: LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data. May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Can cause mild skin irritation. It can be absorbed through intact skin. Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm, it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS) Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include

headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and consciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987). Ingestion: Do not drink, pipet or siphon by mouth. May cause gastrointestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through)]. 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Ethylbenzene Illinois toxic substances disclosure to employee act: Ethylbenzene Illinois chemical safety act: Ethylbenzene New York release reporting list: Ethylbenzene Rhode Island RTK hazardous substances: Ethylbenzene Pennsylvania RTK: Ethylbenzene Minnesota: Ethylbenzene Massachusetts RTK: Ethylbenzene Massachusetts spill list: Ethylbenzene New Jersey: Ethylbenzene New Jersey spill list: Ethylbenzene Louisiana spill reporting: Ethylbenzene California Director's List of Hazardous Substances: Ethylbenzene TSCA 8(b) inventory: Ethylbenzene TSCA 4(a) proposed test rules: Ethylbenzene TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97 SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S24/25- Avoid contact with skin and eyes. S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information**References:**

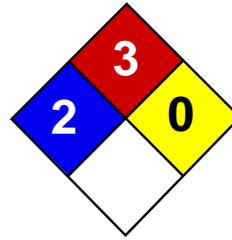
-Manufacturer's Material Safety Data Sheet. -Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA) -Registry of Toxic Effects of Chemical Substances (RTECS) -Chemical Hazard Response Information System (CHRIS) -Hazardous Substance Data Bank (HSDB) -New Jersey Hazardous Substance Fact Sheet -Ariel Global View -Reprotext System

Other Special Considerations: Not available.

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.

MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available.

The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:

Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide; concentrated nitric acid, sulfuric acid + nitric acid; N₂O₄; AgClO₄; BrF₃; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Toxic flammable liquid, insoluble or very slightly soluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States] TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 100 STEL: 150 from NIOSH [United States] TWA: 375 STEL: 560 (mg/m³) from NIOSH [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:

Soluble in diethyl ether, acetone. Practically insoluble in cold water. Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide. Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride. Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C. Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 636 mg/kg [Rat]. Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:

Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin. Eyes: Causes mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abrasions. This usually resolves in 2 days. Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite. Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation. Chronic Potential Health Effects: Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophosphatemia), severe, muscle weakness and Rhabdomyolysis. Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene California prop. 65 (no significant risk level): Toluene: 7 mg/day (value) California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene Connecticut hazardous material survey.: Toluene Illinois

toxic substances disclosure to employee act: Toluene Illinois chemical safety act: Toluene New York release reporting list: Toluene Rhode Island RTK hazardous substances: Toluene Pennsylvania RTK: Toluene Florida: Toluene Minnesota: Toluene Michigan critical material: Toluene Massachusetts RTK: Toluene Massachusetts spill list: Toluene New Jersey: Toluene New Jersey spill list: Toluene Louisiana spill reporting: Toluene California Director's List of Hazardous Substances.: Toluene TSCA 8(b) inventory: Toluene TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92 SARA 313 toxic chemical notification and release reporting: Toluene CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S25- Avoid contact with eyes. S29- Do not empty into drains. S33- Take precautionary measures against static discharges.

HMS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

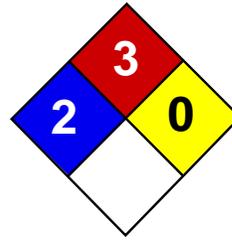
References: Not available.

Other Special Considerations: Not available.

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

p-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: p-Xylene

Catalog Codes: SLX1120

CAS#: 106-42-3

RTECS: ZE2625000

TSCA: TSCA 8(b) inventory: p-Xylene

CI#: Not applicable.

Synonym: p-Methyltoluene

Chemical Name: 1,4-Dimethylbenzene

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{p-}Xylene	106-42-3	100

Toxicological Data on Ingredients: p-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 12400 mg/kg [Rabbit.]. VAPOR (LC50): Acute: 4550 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, kidneys, the nervous system, liver. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Toxic flammable liquid, insoluble or very slightly soluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 434 STEL: 651 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 138°C (280.4°F)

Melting Point: 12°C (53.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 9 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:

Easily soluble in methanol, diethyl ether. Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 5000 mg/kg [Rat.]. Acute dermal toxicity (LD50): 12400 mg/kg [Rabbit.]. Acute toxicity of the vapor (LC50): 4550 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier. 0900 Detected in maternal milk in human. Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: p-Xylene Florida: p-Xylene Massachusetts RTK: p-Xylene New Jersey: p-Xylene TSCA 8(b) inventory: p-Xylene SARA 313 toxic chemical notification and release reporting: p-Xylene CERCLA: Hazardous substances.: p-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R10- Flammable. R38- Irritating to skin. R41- Risk of serious damage to eyes. R48/20- Harmful: danger of serious damage to health by prolonged exposure through inhalation.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Material safety data sheet emitted by: la Commission de la Sant   et de la S  curit   du Travail du Qu  bec. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du r  glement sur le transport des marchandises dangereuses au Canada. Centre de conformit   international Lt  e. 1986.

Other Special Considerations: Not available.

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